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Physico-Chemical and Biological Contamination of Tap Waters Of the Village Chinnamiram, West Godavari Dist, Andhra Pradesh, India.

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Abstract:- *The present study is assessment of water pollution of treated water supply in a rural village. Water pollution is one of the serious environmental problems which have greatly influenced human health. Several viral, bacterial and pathogenic diseases are witnessed due to contaminated water at all areas globally. Improper water supply schemes, obsolete distribution infrastructure and bad sanitary conditions are major problems due to which people are suffering from fatal water-borne diseases. In this study, samples were collected from water supply which is a storage pond, and from treated waters at tap (household) in the concerned area of Chinnamiram village of West Godavari dist. All the samples were analysed for physico-chemical and microbiological analysis. The Total Coliform Count (TCC) and Faecal Coliform Count (FCC) have exceeded the permissible limits prescribed by Drinking Water Specification of IS 10500, BIS 2012. The study clearly emphasizes the importance of good quality treatment required.*

Keywords:- *Water Pollution, Bacteriological Quality, Water-borne Diseases, Faecal Coliform*

I. INTRODUCTION

Water is next to air for survival of living beings on earth. If this water is not available, some living organisms die early and some others die late. Even humans are not exceptional for the above said factor. People depend on surface and ground waters for survival. Both these could get contaminated by pollutants form point and non-point sources. The impact of water on human health is direct and indirect. The direct impacts of water on health are derived from the quality of water consumed and the indirect impacts related to the quantity used for personal, domestic and household hygiene (Knepper et al., 1999).

In terms of human health, most serious pollutant affecting water quality is pathogenic bacteria. From the past history, it has been recorded that water plays a major role in spreading different diseases. It is also well established that faecal contaminated water can spread dangerous diseases like hepatitis, cholera, dysentery, typhoid and diarrhea. Among these, diarrhea is most common. It affects 40% children under 5 years of age. WHO has reported that 80% of all sickness and diseases in human beings were due to waterborne pathogens and inadequate treatment systems (Cunningham, 2005).

The United Nations estimated that at least 2.5 billion populates of the developing countries have no proper sanitation systems. The contribution of point and non-point sources to the pollution is very high and is to be addressed seriously. Agricultural run-off, pesticides, industrial toxic chemicals persist for a long time in environment and contaminate water sources whether surface or ground water. Sewage intrusion such as septic tank effluent is a major problem in the distribution system that finds its entry through leakage (Eichhon et al., 2001). Hence a comprehensive water quality monitoring programme is becoming a necessity in order to safeguard public health and to protect the valuable fresh water resources.

The aim of the present study was therefore to analyse the physico-chemical and bacteriological quality of drinking water at the tap of household and assess the quality that is being consumed by the villagers of the study area selected.

II. MATERIALS AND METHODS

The study area is village Chinnamiram located in Bhimavaram mandal, West Godavari district, A.P. The total area is 1187.03 hectares with a population of 7615. The present study is to monitor the quality of water and to find the problems of treatment in the area under observation. The population is supplied water at the rate of 0.54 MLD. The raw water source is Undi Canal.

The raw water form Undi Canal was treated by slow sand filter and the water is stored in a storage pond for supply. The area consists of two overhead tanks each with a capacity of 1,20,000 L. The water supply is intermittent. The selected water samples were tap waters (consumer points) in the study area. The consumer points shown in the Fig.1 C1A to C1I were supplied water at 6:00 A.M and 4:00 P.M. The consumer points say

C2A to C2J were supplied water at 9:00 A.M. and 6:00 P.M. respectively. Land use of the study area is typically residential. The villagers found to practice poor hygiene and the study area was found to be lacking cleanliness. The samples from source (canal), pond and consumer ends were collected in sterile bottles as per the standard procedures. D.D water was used for the analysis. The samples were analysed for both physico-chemical and bacteriological quality as per the drinking water specification IS 10500, BIS 2012. The samples were enumerated by the membrane filtration technique to determine the presence of coliform bacteria. For coliform analysis, all glassware and tools were sterilized before usage by autoclaving for 20 mins at 120^{o}C.

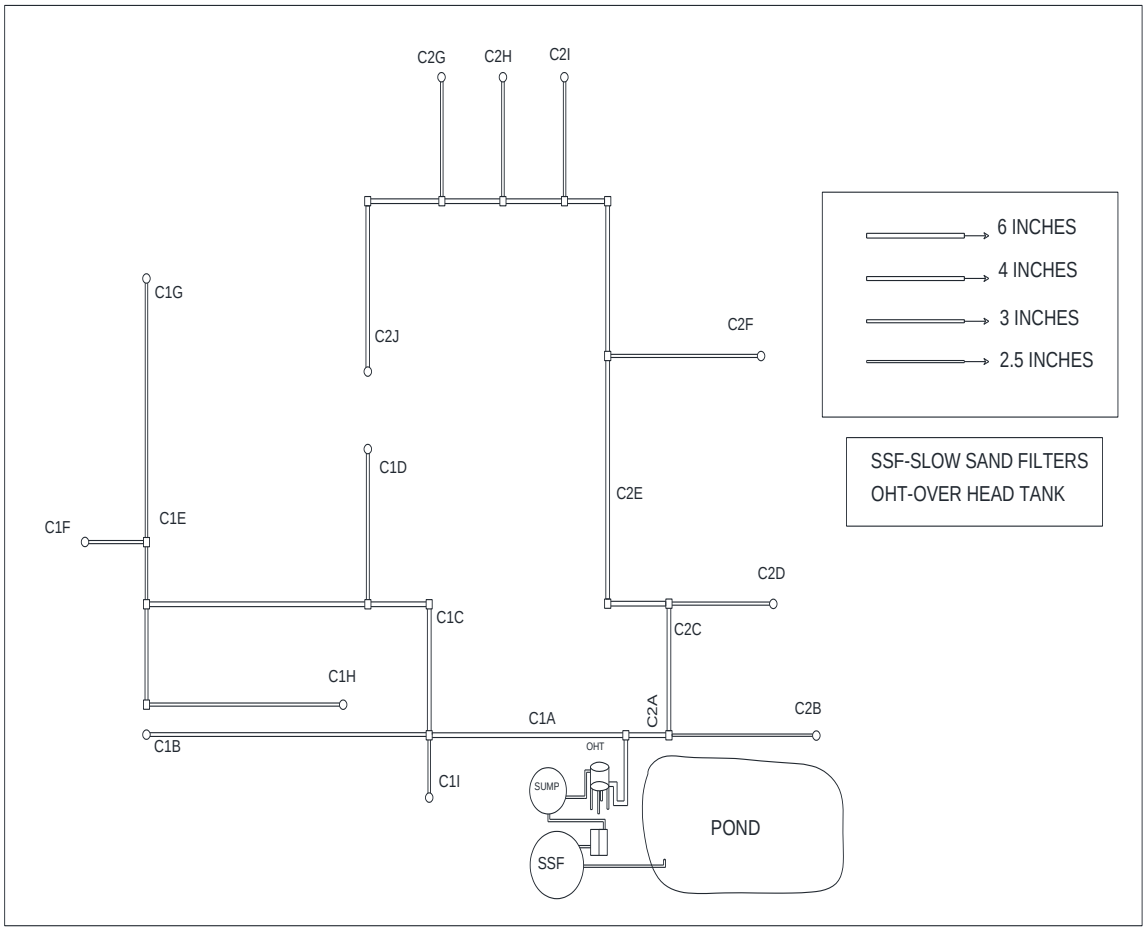

Fig1: Location of 20 sampling stations from source at Chinnamiram village, W.G.Dist., Andhra Pradesh.

Table 1: Drinking water standards for physico-chemical parameters as per recommended agency BIS. (All values except pH and Electrical Conductivity are in mg/L, EC is in µs/cm)

SNO	Parameters	Standards
1	pH	6.5-8.5
2	Electrical Conductivity(EC)	300
3	TDS	500
4	Turbidity	10
5	Total hardness	300
6	Calcium	75
7	Magnesium	30
8	Chlorides	250
9	Nitrates	45
10	DO	5
11	BOD	5

III. RESULTS AND DISCUSSIONS

The results are as shown in Table 2 and Table 3.

Table 2. Physicochemical characteristics of treated waters, source and pond
(All values except pH and EC are in mg/L).

SNO	pH	EC	TDS	Turbidity	Hardness	Ca^{2+}	Mg^{2+}	CL^{-}	NO^{3-}	DO	BOD
Source	8.40	250.00	1410.00	11.20	50.00	16.00	2.40	35.45	1.18	5.80	4.20
Pond	7.66	360.00	240.00	5.60	109.96	32.00	7.30	56.72	0.17	7.00	10.60
C1A	7.77	370.00	250.00	3.40	110.00	24.00	12.20	49.60	0.13	7.50	4.80
C1B	7.77	360.00	250.00	2.90	99.99	24.00	9.73	63.81	0.10	7.30	4.80
C1C	8.70	360.00	240.00	3.60	100.00	28.00	7.30	35.50	0.10	7.20	4.80
C1D	8.50	360.00	250.00	3.80	99.99	20.00	12.16	49.63	0.12	7.50	7.40
C1E	8.10	390.00	260.00	3.00	99.97	28.00	7.30	56.72	0.15	5.10	1.20
C1F	8.38	370.00	250.00	3.60	100.00	24.00	9.73	49.60	0.10	7.80	12.00
C1G	8.59	370.00	260.00	3.20	100.00	20.00	12.20	63.80	0.14	7.40	12.00
C1H	8.50	360.00	250.00	2.90	100.00	24.00	9.73	56.70	0.11	7.50	10.80
C1I	8.42	390.00	260.00	3.10	99.99	16.00	14.58	63.81	0.20	7.20	7.80
C2A	8.18	360.00	250.00	4.10	99.99	24.00	9.73	63.81	0.00	7.50	9.00
C2B	8.31	380.00	260.00	3.60	99.99	28.00	7.31	49.63	0.00	7.80	4.40
C2C	8.11	360.00	250.00	3.30	99.99	24.00	9.73	49.63	0.00	7.40	9.60
C2D	8.12	360.00	250.00	4.40	99.99	28.00	7.31	49.63	0.00	7.60	4.20
C2E	8.12	350.00	240.00	3.20	99.99	20.00	12.16	63.81	0.00	7.60	5.40
C2F	8.13	360.00	250.00	4.10	109.99	24.00	12.16	56.72	0.00	9.40	12.40
C2G	8.10	370.00	250.00	2.80	119.96	24.00	14.58	70.90	0.00	4.60	10.20
C2H	8.28	370.00	250.00	3.20	109.99	28.00	9.73	70.90	0.00	7.90	7.20
C2I	8.07	360.00	250.00	4.20	99.99	24.00	9.73	63.81	0.00	7.20	10.20
C2J	8.19	380.00	260.00	4.30	109.99	24.00	12.16	49.63	0.02	8.30	10.60

Table 3: Bacteriological characteristics of treated waters, source and pond (MPN in CFU/100 ml and Residual Free Chlorine (RFC) in mg/L)

SNO	MPN	F.COL	E.COLI	RFC
Source	≥2400	+	+	0
Pond	≥2400	+	+	0
C1A	460	+	+	0
C1B	150	+	+	0
C1C	460	+	+	0
C1D	2400	+	+	0
C1E	460	+	+	0
C1F	2400	+	+	0
C1G	460	+	+	0
C1H	1600	+	+	0
C1I	0	+	+	0
C2A	≥2400	+	+	0
C2B	43	+	+	0
C2C	≥2400	+	+	0
C2D	460	+	+	0
C2E	240	+	+	0
C2F	≥2400	+	+	0
C2G	93	+	+	0

C2H	460	+	+	0
C2I	≥2400	+	+	0
C2J	≥2400	+	+	0

It was observed that pH of tap waters was found to range from 7.60 to 8.70. All pH values are within acceptable range. All water samples were found to be alkaline in nature and might be due to increase in temperature. Decrease in pH may cause corrosion that destroys pipe material, pumps and other metallic plumbing fixtures. The values of Electrical Conductivity (EC) were found to range from 350 to 390 µS/cm. EC has closed relationship with TDS. The higher EC value indicates that water is saline.

Tubidity was found ranging from 2.9 to 4.4 NTU in all the samples selected. In the storage pond, the turbidity was as high as 5.6 NTU. The study reveals that the range was within permissible limits. Water distribution network in the present study area was found to be very old and due to which leakage was most common.

The chlorides range from 35.45 to 70.9 mg/L. The concentration of chlorides was within the permissible limits. It is because the area does not receive any industrial and commercial runoff.

Total Hardness is mainly a reflection of major ions, e.g., Ca^{+2}, Mg^{+2}, CO_3^{-}, HCO_3^{-} being present in the water. Hardness within the permissible range does not pose any direct impact on health but beyond the limit causes gastrointestinal problems. Indirectly it affects the consumer acceptability in terms of taste (Kannan etal., 1991). The hardness in the study was found to range from 50 to 110 mg/L. Hence there was no problem with the hardness.

Dissolved oxygen is very important in water bodies and water supplies because it is an important respiratory gas responsible for biochemical reactions. BOD is the amount of oxygen needed by microorganisms in water to breakdown complex organic materials into simpler compounds (Abdullah et al., 2008). Nitrates are also important indicator of fertilizer residues as well as waste discharges form live stock. The range of the above said three parameters were within acceptable range.

It was also noted that the average count of total coliform count (MPN) were beyond the range of BIS. In areas, where there is little risk of a water borne outbreak, residual free chlorine (RFC) of 0.2 mg/L is recommended at the points of consumption. In this study, the RFC was found to be zero at all points which indicate the inefficient disinfection practice in the distribution system. Higher counts of bacteria and detection of Ecoli clearly indicate that water was faecally contaminated.

V. CONCLUSIONS

The bacterial count at almost all the points exceeded the permissible range. It is necessary to take necessary measures to prevent spread of fatal pathogens in treated water. Strict control and appropriate management of the distribution system is recommended for the prevention of the contamination. It is important to maintain min RFC in water to prevent contamination. Water, sanitation and hygiene education programs should be in place to the public. Accordingly, recommendations can be made to the local authorities to take suitable control for drinking water source. Efficient management and training for operators is suggested. In addition to the above said, a detailed periodical physic-chemical and bacteriological analysis should be performed before water is supplied to public for consumption.

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