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Z Operation And Maintenance of Water Treatment Plant At Bhimavaram, west Godavari District, A.P., India.

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Abstract:- Safe drinking water, sanitation and infrastructure are three basic rights of an individual for survival on the earth. Rapid growth of population, trend of urbanization has exerted high pressure on water quality emphasizing the development required in treatment and distribution systems. There is a need to study the conventional treatment plant system for their operational status and to find a feasible solution that ensures safety to public.
Water quality is assessed by physico-chemical and biological characteristics. Production of biologically and chemically safe water is the primary goal in the design of water treatment plant. The main aim is to study the water quality at each stage of treatment say sedimentation, filtration and disinfection and clearly explain the importance of each stage in treatment. The operation and maintenance of treatment is also very important for supply of safe drinking water at the consumer point. It also emphasizes the interest of consumer in the quality of drinking water at the tap but not at the treatment plant.

Keywords:- Sedimentation, Filtration, Water quality, Urbanization, Maintenance

I. INTRODUCTION

Water and life have an inseparable relationship and considered as two sides of a coin. All living organisms on our earth are so connected with water that life on the globe is believed to evolve in and around water. Water is equally important to plants, animals, agriculture, infrastructure and industrial uses (Khatavkar et al., 1992).Water resources have been exploited to the maximum extent by man on the earth for all natural and man-made activities. The trend of urbanization has stressed the natural purification of water bodies (Narkhede et al., 2009). Clean drinking water is a basic human need. Unfortunately one in six people still starve for this precious resource in this present developing nation. Hence it is very important to study the process of water treatment plant with all aspects including physical, chemical and bacteriological analysis (Goel et al., 2006).
The main purpose of water treatment is to purify the polluted water and make water fit for drinking by removing unpleasant taste, odour, excess metals etc (Abd – Ali et al., 1993). The water quality required varies with the type of consumption (Paul et al., 2002). The raw water quality in India varies from place to place and it requires different modifications in treatment. The selection of units in a treatment plant change with the raw water quality available. Rapid growth of population has increased water demand which requires extensive treatment of water sources available and developing treatment and distribution systems (CPCB report, 2007).

It is a well known fact that a large number of diseases are transmitted through improper water supplies contaminated with human and animal excreta. It is highly impossible to monitor each and every pathogen in drinking water. Therefore, it becomes necessary to detect some non-pathogens that act as indicator species like coliform bacteria. Coliform bacteria are detected by Multiple tube fermentation technique used as an indicator of sewage contamination (WHO Guidelines, 1993).

II. MATERIALS AND METHODS

2.1 Study Area

Bhimavaram town is located in the middle of the Godavari Delta region Narsapuram and Gudivada – Bhimavaram broad gauge section of the south central Railway. It also lies at latitude 16°35° North and longitude 81°31° East. The Municipality was spread over 25.60 sq km with a population of 1,42,184 as per 2014 census. The town serves as a commercial centre, to its hinterland with its agro and aqua based economy. The water treatment plant is situated in the study area at Vendra with a capacity of 8.97 MLD. The source of water for the scheme is Gostani Velpur canal.

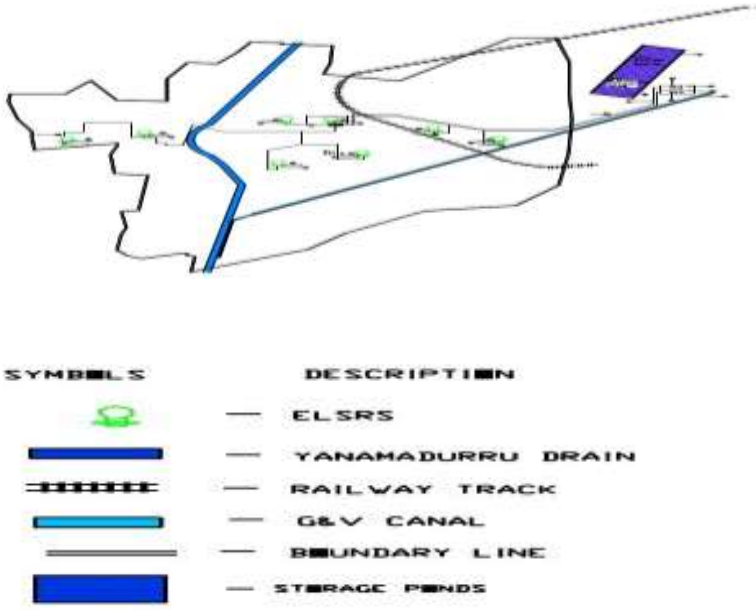

Figure 1: Study Area

Present study has been conducted to observe and access the existing methodologies used for treatment in the study area and to understand the process of treatment. The treatment plant scheme consists of three main unit operations like clariflocculator, rapid sand filter and gas chlorinators.

2.2 Conventional Clarification

It typically refers to chemical addition, rapid mixing, flocculation and sedimentation. Removal of particles depends mainly on settling velocity of the particles and the rate of surface loading. In the absence of a chemical coagulant, removal of pathogens is low because sedimentation velocities are low (Medema et al., 1998). On an average, the microbial removals for coagulation and sedimentation range from 32 to 87 % for coliform bacteria (Gimbel & Clasen, 1998). However removal efficiencies are highly site-specific and change from place to place.

2.3 Conventional Filtration

Rapid Sand Filters were used in the concerned treatment scheme taken for the study. Without proper chemical treatment, rapid rate filtration works as a simple strainer and is not an effective barrier for microbes. Al-Ani et al., 1986 has studied the removal efficiency of bacteria with and without coagulant addition. Adding chemicals, the removal efficiency in many plants have shown to improve it to 99% for total coliform bacteria and 70 % for turbidity. Backwashing is done to improve the working of filter beds and it is an effective measure to conserve wash water effectively.

2.4 Conventional Disinfection

The principal factors that influence disinfection efficiency are disinfectant concentration, contact time, temperature and pH. Gas Chlorinators were used in the treatment plant under study. In this scheme, adequate amount of chlorine was being added. The operators should be properly trained from time to time regarding fatal chlorine gas and its hazards. The Management should take strict measures to avoid accidents in the disinfection zone.

III. RESULTS AND DISCUSSION

It was found that the turbidity was not too high in raw water. Turbidity was a major indicator for pollution and the use of raw water as a source is acceptable. In this study, four different types of water samples were taken for the analysis at different stages of treatment: raw water, settled water, filtered water and treated water to check the efficiency of treatment at each stage. The samples taken for the analysis were analysed for summer and winter seasons as per APHA, 2003. The objective of the present study is to ensure that water supplied is confirming to BIS, 10500. The water at all the stages was analysed for physical, chemical and biological quality. D.D. water was used for the analysis.

The results were as shown in Table 1 and Table 2.

Table 1. Physico-chemical and biological characteristics of water at different stages of treatment in winter

S.NO	Parameter	Raw Water	Settled Water	Filtered Water	Treated Water
1	pH	7.96	7.93	7.76	7.5
2	Turbidity	17	10	7	5.1
3	TDS	160	205	210	200
4	EC	240	320	315	300
5	Hardness	140	140	120	110
6	Calcium	20	16	40	20
7	Magnesium	21.86	24.29	4.88	14.58
8	Alkalinity	100	155	175	190
9	DO	5	4.8	5.7	5.4
10	BOD	5.4	4.2	1.8	1.2
11	COD	19.2	16.1	11.1	9.6
12	Chlorides	21.27	67.36	92.17	92.17
13	RFC	0	0	0	0.1
14	MPN/100 mL	≥2400	≥2400	157	0
15	TFC/100 mL	≥2400	1200	0	0

Table 2. Physico-chemical and biological characteristics of water at different stages of treatment in summer

S.NO	Parameter	Raw Water	Settled Water	Filtered Water	Treated Water
1	pH	7.5	7.25	6.88	6.77
2	Turbidity	9	12	7	4.5
3	TDS	180	190	190	190
4	EC	280	300	300	300
5	Hardness	140	120	120	140
6	Calcium	32	32	32	24
7	Magnesium	14.5	9.73	9.73	19.4
8	Alkalinity	70	90	90	80
9	DO	6.3	6.2	5.4	6
10	BOD	4.8	4.8	2.4	1.2
11	COD	25.6	19.2	19.2	9.6
12	Chlorides	56.72	70.9	56.72	42.54
13	RFC	0	0	0	0
14	MPN/100 mL	≥2400	1600	140	0
15	TFC/100 mL	≥2400	1100	23	0

The results were clear that the treatment was proper in the treatment plant at each stage and the treated water was completely confining to the drinking water quality standards.

The percentage removal was evaluated by the following equation.

Removal efficiency = ((Parameter inside – Parameter outside) / Parameter inside) * 100

The removal efficiencies of each stage of treatment were as shown in Table 3 for both the seasons.

Table 3. Removal efficiency at each stage of treatment in winter and summer seasons

Parameter	Winter			Summer		
	Sedimentation	Filtration	Chlorination	Sedimentation	Filtration	Chlorination
pH	0.38	2.14	3.35	3.33	5.10	1.60
Turbidity	41.18	30.00	27.14	-33.33	41.67	35.71
TDS	-28.13	-2.44	4.76	-5.56	0.00	0.00
EC	-33.33	1.56	4.76	-7.14	0.00	0.00
Hardness	0.00	14.29	8.33	14.29	0.00	-16.67
Calcium	20.00	-150.00	50.00	0.00	0.00	25.00
Magnesium	-11.12	79.91	-198.77	32.90	0.00	-99.38
Alkalinity	-55.00	-12.90	-8.57	-28.57	0.00	11.11
DO	4.00	-18.75	5.26	1.59	12.90	-11.11
BOD	22.22	57.14	33.33	0.00	50.00	50.00
COD	16.15	31.06	13.51	25.00	0.00	50.00
Chlorides	-216.69	-36.83	0.00	-25.00	20.00	25.00
RFC	0.00	0.00	0.00	0.00	0.00	0.00
MPN/100 mL	0.00	0.00	100.00	0.00	91.25	100.00
TFC/100 mL	0.00	0.00	0.00	0.00	97.91	100.00

It was clear that that all the parameters analysed were within the permissible limits and the removal efficiency calculated at chlorination stage was high in summer compared to winter. Total Faecal Coliform (TFC) was found zero and the removal efficiency was found to be 100%. But it was seen that the concentration

of residual free chlorine (RFC) was zero and there is a scope for future contamination. RFC of 0.2 mg/L is recommended at the points of consumption.

IV. CONCLUSION

The study on water treatment plant at Vendra, Bhimavaram, W.G.Dist, India revealed that an appropriate pattern of operation and maintenance was followed. Regular training to plant operators is suggested for updating. The adequacy of water treatment from health point of view is ensured by maintaining residual chlorine of 0.2 mg/L at the farthest point of distribution system. The water treatment plant should have a facility of MPN testing. The consumer is interested in the quality of the water at the tap, not the quality at the treatment plant. Therefore the water utility operations should be such that the quality is not impaired during transmission, storage and distribution system.

V. REFERENCES

[1]. APHA 2003, Standard Methods for the examination of Water and Wastewater, 20th edition, American Public Health Association, Washington D.C.
[2]. Abd – Ali, A.H.; 1993. A statistical study on some effects of aggressive war upon the quality of water in the city of Baghdad. Master thesis, University of Technology. Iraq.
[3]. Al-Ani MY et al., 1986. Removing Giardia cysts from low turbidity waters by rapid filtration. Journal of the American Water Works Association, 78(5):66-73
[4]. BIS 2012. Bureau of Indian Standards, IS: 10500, Manak Bhavan, New Delhi, India.
[5]. Gimbel R, Clasen J(1998). International Report: removal of micro-organisms by clarification and filtration processes. Water Supply, 16:203-208.
[6]. Goel P.K., Water Pollution: Causes effects and Control, Published by New Age International, New Delhi (2006).
[7]. Khatavkar, S.D., and R.K. Trivedy 1992. Water quality parameter of river Panchaganga near Kolhapur and Ichalkaranji Maharashtra. J. Ecotoxicol. Environ.monit. 2(2) : 113 – 118.
[8]. Medema GJ et al.(1998). Sedimentation of free and attached Crystosporidium oocysts and Giardia cysts in water. Applied and Environmental Microbiology, 64:4460 – 4466.
[9]. Narkhede, R.K., Patwari, J.M., Nagpurne, V.S., and Dapkekear, S.M., 2009. Assessment of Godavari River Water Quality in relation to biochemical oxygen demand and chemical oxygen demand at Nanded, Maharashtra. Shodh, Samiksha and Mulyankan (International Research Journal – ISSN – 0974 – 2832. Vol.II, Issue – 5 (Nov.08 – Jan.09)
[10]. Paul F., Zheng Wu, Chun Hou Orr, " Optimal pump operation of water distribution systems using Genetic algorithms", Mw Soft, Inc., 300 north lake avenue, suite 1200 pasadena, CA, 91101 USA, pp. 14. (2002).
[11]. Status of water treatment plants in India, CPCB report (2007).
[12]. WHO (1993). Guidelines for drinking – water quality, 1st ed., World Health Organization, Geneva.