

# International Journal of Innovative Research in Science, Engineering and Technology

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## Performance of Drinking Water Treatment Plant

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**ABSTRACT:** To implement performance assessment, it is necessary to develop adequate and representative performance indicators. Good performance indicators can specify the measurable evidence that is necessary to document the achievement of a goal. To provide the higher quality and stable water to the customers, the water utilities themselves should establish the proper maintenance and management programs to enhance the availability of plant facilities and equipments in the water treatment plant. With the appropriate performance indicators, the objectives and/or targets of the business plan can be evaluated quantitatively. The aim of this research work is to set up the performance evaluation system. After the establishment of performance indicators seven in this research, the corresponding evaluation items and their relative weights were revealed throughout forum discussion and questionnaire survey and based on the comprehensive performance evaluation technique.

**KEYWORDS:** achieve the objectives of safe drinking water and clean water

### I. INTRODUCTION

To implement performance assessment, it is necessary to develop adequate and representative performance indicators. Good performance indicators can specify the measurable evidence that is necessary to document the achievement of a goal. To provide the higher quality and stable water to the customers, the water utilities themselves should establish the proper maintenance and management programs to enhance the availability of plant facilities and equipments in the water treatment plant. With the appropriate performance indicators, the objectives and/or targets of the business plan can be evaluated quantitatively.

### II. OBJECTIVE

The objective of a public protected water supply system is to supply safe and clean water in adequate quantity, conveniently and as economically as possible. The water supply projects formulated by the various state authorities and local bodies at present do not contain all the essential elements for appraisal and when projects are assessed for their cost benefit ratio and for institutional or other funding, they are not amenable for comparative study and appraisal. Therefore, on Water Supply & Treatment specify appropriate standards, planning, and to avoid empirical approach. For providing continuous and good quality of water to all the regions in Maharashtra throughout the year, Govt. of Maharashtra has constructed new water treatment plant. The Physico-chemical analysis is proposed to be conducted to investigate water quality. The conclusion drawn from the study will outline the importance of accurate engineering design and need for continuous monitoring and analysis of each unit performance.

Raw water treatment facility comprising of clarification and filtration has been installed to supply potable water for domestic of yavatmal in Maharashtra. This facility is meant for removing suspended/colloidal matter and some organic matter from the raw water. The treatment scheme envisages a system for adequately purifying the water from aquatic and biological contaminants to produce a water safe for human consumption. The yavatmal city is located in western Maharashtra. The present population of yavatmal is 3,05,000. The water supply to city is arranged from chapdoh treatment plant having capacity 17.64 MLD. The chapdoh is located in yavatmal city. The water treatment plant is

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constructed in 1986. The source of water is waghadi river. The water is being treated and supplied to the city. The design and construction of the plant is conventional one.

### III. INTAKE STRUCTURES

Surface intake structure

- 1.River
- 2.Ponds
- 3.Lakes

Sub surface intake structure

- 1.Wells
- 2.Infiltration galleries
- 3.Infiltration Wells

The main source of supply to water treatment plant is waghadi river.

### IV. OBJECTIVES OF THE TREATMENT PROCESS

The main objective of the treatment process is to guarantee the requirements on the drinking water quality, which is described in national and international regulations. However there are further requirements which are determined by the circumstances, that there are always organic particles in a surface water and that the water is usually distributed through long distance distribution systems. To guarantee the final disinfection as well as the removal of parasites, the water should have a very low turbidity ( $< 0.1 - 0.2$  FNU) after the treatment process. Pathogens, which are included in or adsorbed on organic particles are protected against the disinfectants and parasites may not be inactivated by using usual disinfectants. Further the chlorophyll concentration in the treated water should be below  $0.1 \mu\text{g/l}$ , to limit the concentration of algae. Higher algae concentration cause an higher formation of disinfection byproducts as well as an higher risk for bacterial regrowth in the distribution system. Further dying algae may be the source of taste and odor problems of the drinking water. To avoid hydraulic problems in the distribution system as result of manganese deposition, the manganese concentration in the treated water should be  $< 0.02 \text{ mg/l}$

### V. TREATMENT PROCESSES OF WATER PURIFICATION

- 1.AERATION
- 2.SEDIMENTATION
- 3.FILTRATION
- 4.CHLORINATION

### VI. AERATION

The unit is provided of the removal of volatile substance, dissolved gas and oxidation of reducing substances like Fe, Mn, etc by way of aeration. The raw water discharges at the center of the concentric aeration fountain through the central inlet shaft and flows down the steps to the peripheral launder. During the trickling down process along the steps, the raw water gets sprayed in fine streams and gas exchange between water and atmosphere takes place and also the reducing substances in the water get oxidized. The water collecting in the peripheral launder is conveyed to the subsequent unit.

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Unit description

No. of aeration fountain -1

Material of construction –RCC

Diameter of cascade aeration fountain -8.050m

No. of steps-5

Drop in each step-250mm

## VII. SEDIMENTATION

The process of removing suspended particle by gravitational settling.

The clariflocculator is a concentric tank with a flocculation zone being inside and the outer being the clarifying zone for sedimentation. The raw water carrying the flocs enters the clarifying zone through the water opening of the flocculation chamber. In the zone below the flocculation chamber, the flow is first to better settling efficiency. The clear water in the clarification zone flow upward at a very slow rate and adequate detention time if provided for gravitational settling of flocs at the floor of the clariflocculator. The settled flocs are collected in central circular channel around the inlet column by a set of scraper arms fixed to a rotating MS bridge. The bridge rotates on a rail at a very slow speed thereby aiding the process of scraping of settled sludge towards the central circular channel. The central sludge channel is provided with a local depression to accommodate a chamber from where the collected sludge is withdrawn periodically for disposal through the manhole. The clear water leaving behind the settleable solids overflows into the peripheral launder and is led to the subsequent unit for further treatment.

Unit Description –

No. of units/type - 1 no. radial flow clarifier with concentric flocculator.

Material of construction - R.C.C.

Design flow to the clariflocculator - 725 m<sup>3</sup>/ hr

## VIII. FILTRATION

The process of removing particulate matter which are not removed by sedimentation.

The clarified water collected in the peripheral launder around the clariflocculator flows into the filter inlet channel. The filtering media consists of sand and gravel of desired sizes and quality. Each filter is provided with an inlet, outlet, wash water inlet and waste water drain outlet. The filter outlet is provided with a rate of flow controller to maintain uniform rate of filtration through the filters. The clarified water contain the residual suspended matter passes down the filter during which the solids are retained on the top of the filter media, reflects in the increased loss of head across the filter bed and also the reduction in the rate of filtration. Filter water stored in the wash water tank is used for backwashing filter beds. The filtered water flows to the pure water sump through the pure water channel where appropriate quantity of bleaching powder solution is added to effectively disinfect the water for potable use.

Unit Description

No. of units - 5 nos.

Material of construction - R.C.C.

Type - rapid sand filter

## IX. DISINFECTION

It is the process of killing pathogenic bacteria from water. In this process chlorine is added for the killing the bacteria. The filter water from the filter beds flows through the pure water channel to the sump before entering the pure water to the sump. It flows through the chlorine contact tank (C.C.T) chlorine gas is added to the filtered water in this tank for disinfection of water. appropriate quantity of chlorine gas is added in the filter water through piping arrangement so as to leave the desired residual chlorine

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Unit description  
Type of chlorination - Gravity  
No. of chlorination - 2 nos.  
Capacity of chlorinator - 3 kg/hr

## X. RESULT

### TESTS TO BE CONDUCTED DURING PROJECT WORK

PH VALUE TEST  
ALKANITY TEST  
TURBIDITY TEST  
JAR TEST

#### PH TEST

S r n o	SAMPL E DETAIL S OF VARIO US PROCES S	Dated						
		18/ 1/1 4	31/ 1/1 4	5/2/ 14	13/ 2/1 4	21/ 2/1 4	6/3/ 14	20/ 3/1 4
1	aeration	7.2 6	7.7 5	7.7 9	7.6	-	7.8	7.7
2	clariflocc ulation	7.6 5	7.8 1	7.7 6	7.6 4	7.9	7.9	7.6
3	filtration	7.6 1	7.6 5	7.7 1	7.5	7.7	7.7	7.6
4	disinfecti on	7.5 0	7.5 8	7.5 9	7.6	7.5	7.6	7.5

#### TURBIDITY TEST

S r n o	SAMPL E DETAIL S OF VARIO US PROCES S	Dated						
		18/ 1/1 4	31/ 1/1 4	5/2/ 14	13/ 2/1 4	21/ 2/1 4	6/3/ 14	20/ 3/1 4
1	aeration	2.4	2.5	6.3	3.3	-	0.9	0.7
2	clariflocc ulation	1.7	1.2	5.8	2.6	1.3	0.7	0.6
3	filtration	0.5	0.9	0.4	0.6	0.3	0.3	0.5
4	disinfecti on	0.3	0.3	1.2	2.9	0.4	0.2	0.4

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### CONDUCTIVITY TEST

Sr no	SAMPLE DETAILS OF VARIOUS PROCESS	Dated			
		5/2/14	13/2/14	6/3/14	20/3/15
1	aeration	0.49	0.44	0.41	0.43
2	clariflocculation	0.88	0.42	0.41	0.44
3	filtration	0.49	0.43	0.42	0.45
4	disinfection	0.50	0.43	0.42	0.44

### ALKALINITY TEST

Sr no	SAMPLE DETAILS OF VARIOUS PROCESS	Dated					
		18/1/14	5/2/14	13/2/14	21/2/14	6/3/14	20/3/14
1	aeration	100	70	60	-	32	34
2	clariflocculation	80	75	56	32	44	31
3	filtration	76	72	52	24	48	28
4	disinfection	40	36	40	18	64	20

### HARDNESS TEST

Sr no	SAMPLE DETAILS OF VARIOUS PROCESS	Dated			
		5/2/14	13/2/14	6/3/14	20/3/14
1	aeration	192	160	160	144
2	clariflocculation	132	56	128	132
3	filtration	80	52	112	124
4	disinfection	40	40	96	108

**Standards of drinking water as per Bureau of Indian standards: IS 10500:2012.**

Sr no	parameter	Requirement (acceptable limit)	Permissible limit
1	Colour, hazan unit, max	5	15
2	odour	agreeable	agreeable
3	Ph value	6.5-8.5	No relaxation
4	taste	agreeable	agreeable
5	Turbidity, NTU, max	1	5
6	Total dissolved solid, mg/l, max	500	2000
7	Total alkalinity as calcium carbonate, mg/l, max	200	600
8	Total hardness (as CaCO <sub>3</sub> ), mg/l, max	200	600

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## XI. CONCLUSIONS

The conclusions that can be drawn from these engineering and laboratory investigations can be summarized as follows:

- 1- Adequate engineering design is essential for successful operating plant.  
Simple design considerations for retention time, velocity, surface loading rate and dosage must be followed.
- 2- Rapid sand filters sand should be according to standards.
- 3- Continuous maintenance and analysis will lead to precise evaluation of plant performance and definition of any required modifications.

## REFERENCES

1. M.A. Eldib and Mahmoud A. Azeem Elbayoumy "Evaluation Of A Water Treatment Plant Performance- Case Study" in Seventh International Water Technology Conference (IWTC-7) held in Egypt 1-3 April 2003.p.p. 471-478.
2. Sujit Kumar Bhattacharya & Ratan Kishore Choudhary "Performance of Engineering Parameter of a water Treatment Plant A Case Study" paper published in 28th WEDC conference on Sustainable Environment Sanitation and Water Services at Kolkata (Calcutta), India, 2002.
3. Dhaneshwar R. S., Sharma V.P., Raut T., Gupta R. K., Kelkar P.S. and Paramasivam R "Performance Evaluation of Five Urban Water Treatment Plants in Utter Pradesh" paper published in Indian Water Works Association Journal, edition-Jan-March, 1991.p.p. 23-30
4. CPHEEO "Manual on Water Supply and Treatment" Third Edition published by Ministry of Urban
5. [www.iwwa.info/index.htm](http://www.iwwa.info/index.htm)
6. [www.tsawatersystems.in/index.asp](http://www.tsawatersystems.in/index.asp)
7. [www.iwtc.info/2003\\_pdf/07-5.pdf](http://www.iwtc.info/2003_pdf/07-5.pdf)