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Short Communication

Operation and Maintenance of Water Treatment Plant at BNP Campus Dewas, India: A Case Study

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Abstract

The trend of urbanization in India is exerting stress on civic authorities to provide basic requirement such as safe drinking water, sanitation and infrastructure. The rapid growth of population has exerted the portable water demand, which requires exploration of raw water sources, developing treatment and distribution systems. There is a need to study the water treatment plants for their operational status and to explore the best feasible mechanism to ensure proper drinking water production with least possible rejects and its management. A case study has been conducted to evaluate the process of treatment and to find out the problems of drinking water treatment process in the unit situated at Bank Note Press Dewas MP, India. In general, conventional treatment is provided having a sequence of alum addition, coagulation, flocculation, sedimentation, filtration and disinfection by chlorination. Water treatment plants are playing an important role in purifying and supplying the pure water to the people. The overall processing and management of water treatment plant located in BNP campus, Dewas, MP, India, fulfils the requirements of the people in the campus. The operation and maintenance needs to be updated for the current requirements of people and to match up with some other plants at national and international level.

Keywords: Water treatment plant, urbanization, operational status, maintenance.

Introduction

Water is a precious commodity. Most of the earth water is sea water. About 2.5% of the water is fresh water that does not contain significant levels of dissolved minerals or salt and two third of that is frozen in ice caps and glaciers. In total only 0.01% of the total water of the planet is accessible for consumption. Clean drinking water is a basic human need. Unfortunately, more than one in six people still lack reliable access to this precious resource in developing world.

Study of water treatment plant is carried out with all aspects and considerations including physical, chemical and bacteriological, to determine its efficiency and to produce water quality[1]. This study will define design and operating problems and difficulties of the case study that will allow for proper revision of these aspects to redefine and suggest recommendations for proper operations. The findings of work may be applicable for other WTP either under design or operation. Importance of continuous monitoring and analysis laboratory works to evaluate performance before and after each treatment unit has been illustrated[2].

India accounts for 2.45% of land area and 4% of water resources of the world but represents 16% of the world population. With the present population growth-rate (1.9 per cent per year), the population is expected to cross the 1.5 billion mark by 2050. The Planning Commission, Government of India has estimated the water demand increase from 710 BCM (Billion Cubic Meters) in 2010 to almost 1180 BCM in 2050 with domestic and industrial water consumption expected to increase almost 2.5 times. The trend of urbanization in India is exerting stress on civic authorities to provide basic requirement such as safe drinking water, sanitation and infrastructure. The rapid growth of population has exerted the portable water demand, which requires exploration of raw water sources, developing treatment and distribution systems[3].

The raw water quality available in India varies significantly, resulting in modifications to the conventional water treatment scheme consisting of aeration, chemical coagulation, flocculation, sedimentation, filtration and disinfection. The backwash water and sludge generation from water treatment plants are of environment concern in terms of disposal. Therefore, optimization of chemical dosing and filter runs carries importance to reduce the rejects from the water treatment plants. Also there is a need to study the water treatment plants for their operational status and to explore the best feasible mechanism to ensure proper drinking water production with least possible rejects and its management. With this backdrop, the Central Pollution Control Board (CPCB), studied water treatment plants located across the country, for prevailing raw water quality, water treatment technologies, operational practices, chemical consumption and rejects management[4].

Though, water is continuously purified by evaporation and precipitation, yet pollution of water has emerged as one of the most significant environmental problems of the recent times. Not only there is an increasing concern for rapidly deteriorating supply of water but the quantity of utilizable water is also fast diminishing[5]. The causes of such a situation may be many, but gross pollution of water has its origin mainly in urbanization, industrialization, agriculture and increase in human population observed in past one and a half century.

Dewas district is situated between 75°55' and 77°09' Longitude 22°19' and 23°19' Latitude. The district is an important district of Malwa region of the state of Madhya Pradesh, India. The population as projected for the year 2001 is 13, 10,968. There are 1058 habituated villages in the district. The district has 6 Tehsils and 5 Assembly segments. The total area of the district is 7020 Sq. kms. The district has 4, 26,000 hectare, of land under agriculture out of which 1, 66,161 hectare is covered by irrigation facilities. It is important to mention here is that about 83% of the agricultural area covered under irrigation is irrigated through ground water sources i.e. wells and tubewells[6]. The major rivers of the district are Narmada, Kshipra, Kalisindh, and Lodhri. The average rainfall of the district is 1067.10 mm. The major crops are soybean, cotton wheat and gram.

WTP at Dewas: The plant is situated in the campus of Bank Note Press, with a capacity of 4.54 M.L.D. The source of water for the scheme is Lakhunder reservoir situated at shajapur. Other specific features of the plant are given in table-1.

Present study has been conducted to observe and access the existing methodologies used for treatment of drinking water at Water Treatment Plant, Bank Note Press, Dewas, MP, India unit and to understand the process of treatment, to find out quality and quantity of water at the unit under observation. And to find out the problems of drinking water treatment process in the unit at Dewas.

Material and Methods

Four different types of water samples have been taken for the analysis at different stages of treatment: raw water, settled water, filtered water and supply water. All the four water samples were taken at fifteen day interval from September 2011 to December 2011. The aim of the laboratory test is to ensure that potable water confirming to BIS, 10,500 is supplied to consumers. Physical, chemical, and bacteriological tests conducted to determine the quality of water, to ensure that treatment of water is properly done during each phase or stage of treatment and to examine whether the treated water confirms to standards[7].

Results and Discussion

Characteristics of raw water were obtained from BNP water treatment plant. The processed information is summarized in table-2 It can be seen from these table that primary parameters of concern is turbidity. The level of pollution is not too high that its use as raw water source is not a major issue of concern. The raw water quality at this location may be considered suitable in respect of ability of treatment plants to produce good quality treated water.

Coagulation and Flocculation: Alum is being added as coagulant in many water treatment plants in India. However, some water treatment plants at Nashik and Pune have started using poly aluminium chloride (PAC) instead of alum, which is in liquid form. Water treatment plants personnel appeared to prefer PAC as no solution is to be prepared as in case of alum. Bhandup water treatment plant complex, Mumbai, use aluminium ferric sulphate as a coagulant, which is one of the biggest plants in India. In water treatment plant at BNP alum is used as coagulant. This could be replaced by (PAC) or aluminium ferric sulphate.

Clarifier: Clarifier sludge samples from water treatment plant are not disposed off properly. Results from different studies shows that mostly clarifier sludge exceeds general standard (suspended solids 100 mg/l), therefore, there is a need to have a mechanism to make it fit before disposal. Sludge may be dewatered and disposed safely, inconformity with existing guidelines. Clarifier sludge should be properly dewatered and disposed off. In case of this water treatment plant sludge is dewatered and disposed off safely.

Filter Backwash: The quantity of filter backwash water is normally about 5%. It can easily be recycled to the inlet of water treatment plant, as about 20 times dilution would be available at the inlet. Filter backwash waters should be recycled to conserve water. Analysis results show that often filter backwash waters exceed general disposal standards. This emphasizes the need for treatment before disposal. Reuse of filter backwash waters, which already being practiced, shall be explored by other water treatment plants.

Chlorinators: Water treatment plants are provided with vacuum type chlorinator; here bleaching powder is also used sometimes for chlorination. In this water treatment plant, chlorine was being added in adequate quantity. Chlorinator in this water treatment plants was found to be in order and proper amount of chlorine was being used.

Chemical usage and Consumption: Proper arrangements for alum feeding are there in this WTP. In India only water treatment plant at Delhi is using ozonation. Here ozonation is being done for oxidizing iron, as water source is rainy wells, which contain iron. It can be seen that chemicals used were alum and chlorine. Lime was also used in lower quantity. It reveals that there is many folds increase in alum dose during monsoon period in comparison to non monsoon period due to high turbidity. This also means more sludge generation.

Operation and Maintenance of Water Treatment Plants: Operation and maintenance of this water treatment plant is satisfactory. Operation and maintenance conditions in this water treatment plants operated by Public Health Engineering Departments. Repair of equipment is not done timely for lack of funds.

Conclusion

The study on water treatment plant at BNP campus, Dewas, India revealed that a set pattern of operation and maintenance is being followed due to which it continues to fulfil the requirement of the people. The alum dose ranges from 30-80 mg/l and the dosing equipments were also found satisfactory. Algae growth was not significant in the filters. However, in open filters, frequent cleaning of filter bed walls is required. Use of ozone, potassium permanganate, copper sulphate etc., may be explored through research and development activity for algae problem or any other contamination of water source. Regular training to the plant operators for proper functioning of the system is suggested. Efficient MIS (Management information system) should also be developed to cater to all the activities of the plant.

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Table -1
Details of WTP at BNP campus Dewas

Capacity of the scheme		4.54 M.L.D.
Capacity of source		Lakhunder Reservoir Dist. Shajapur.
Capacity		32.150M. CU. M.
Intake		Siphon System
Raw water pumps		2 No's 1600 LPM Discharge, 190-M Head, Centrifugal Horizontal Type Plus One Standby
Raw water conveyance		30 MM Φ D.I. 42.25 KM
Treatment plant		4.54 M.L.D (BNP Campus Dewas)
Clear water pumps		2 NO'S 1570 LPM, 25M Head Centrifugal Type Plus One Standby
Estimated cost		RS. 11.95 CRORES.
Annual running and maintenance cost		
A.	With capital recovery consideration	RS. 226.67 LACS
B	Without capital recovery consideration	RS. 98.62 LACS
Cost of production per 1000 litres		
A.	With capital recovery consideration	RS. 13.80
B.	Without capital recovery consideration	RS. 6.00

Table -2
Details of WTP at BNP campus Dewas

Parameters	**Raw Water**		**Settled Water**		**Filtered Water**		**Supply Water**	
	Max.	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**
Alum+Lime (ppm)	60+20	50+15	NA*	NA*	NA*	NA*	NA*	NA*
pH	8.3	7.4	7.58	6.6	7.86	6.8	8.3	7.3
Turbidity NTU	83	11.3	35	3	12	0	4	0.2
Temperature OC	37	32	NT**	NT**	NT**	NT**	NT**	NT**
Total Alkalinity mg/litre	170	140	152	116	150	110	162	110
Total Hardness mg/litre	160	120	166	134	164	132	164	128
Calcium Hardness mg/litre	108	60	118	77	122	78	108	70
Magnicium Hardness mg/litre	60	30	71	14	76	20	78	28
Chloride Mg/litre	40	24	38	22	34	22	45	28
Conductivity MS/cm2	349	262	419	294	396	270	382	272
T.D.S. mg/l	136	91	148	110	154	105	150	104
Residual Chlorine mg/l	NA*	NA*	100	32	102	45	100	40
MPN	920	130	280	46	180	26	4	0