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Performance Appraisal and Proposed Agumentation in Water Treatment Plant

Chaitali K. Hade, Anupreet P. Ghodki, Manisha S. Ambhore, Kirtee M. Sawade, Prof. S. J. Thigale
Department Civil Engineering,
Email: ajinkyaghodki@gmail.com

Abstract-.This paper focus on the overall performance of existing water treatment plant at Yelgaon Dist Buldana using different methods. This plant is situated on Yelgaon dam having storage capacity 1.24*10^9 cubic meter. This helps us to improve the quality and quantity of water required for Buldana city. The raw water is collected from yelgaon dam which is an earthen dam. The capacity of water treatment plant is 882 cu.m/hour. An attempt has been made for detailed study of each process A conventional water treatment plant consist of aeration, coagulation, sedimentation, filtration and disinfection units.

Key words - Conventional water treatment plant, aeration, coagulation, sedimentation, filtration

1. INTRODUCTION

Water is vital to human life, from agriculture to industrial products. Recently due to population increases, industrial development and transition to modern consumer society, contamination of the water system often occurred.

In Maharashtra, one major implementing agency belonging to Government of Maharashtra is currently responsible for rural as well as urban water supply schemes. The Maharashtra water supply and Board constituted on 1st Jan, 1997under Maharashtra water supply sewage board Act 1976, for rapid development and proper regulation of water supply and sewage service in the state. This was changed as Maharashtra Jeevan Pradhikaran with effect from 10th March, 1997.

The population of Buldana city is 67430 as per census 2011. The storage capacity of dam is 1.24*10^9 cu.meter. Bhadola, Jambhrun and Sagwan are the villages comes under this water treatment plant. Buldana is a Major developing district in Maharashtra State. It is situated on Malkapur-Solapur State Highway No. 160 and 156. The rainfall is moderate to heavy in the area and monsoon comes generally in 2nd and 3rd week of June.

2. LITERATURE REVIEW

An extensive review of literature on prior work conducted in the field of study has been presented in this chapter.

Malhotra (1994) highlighted that usage of alum result in a huge volume of sludge, which in turn results in wastage of water. The auther investigated the efficiency of PAC against solid alum.

Malgorzata (2011) proposed an ANN based model to predict water quality after coagulation and filtration processes using an immersed membrane, various

structures of multilayer perceptron with one hidden 12 layer were created. Feed water turbidity, turbidity in a tank, pH and temperature in the tank as well as trans membrane pressure and pressure flux were treated as input signals. Based on the best network chosen, prediction of water quality was done.

Shahin et al. (2010) presented a study about the performance of the coagulant poly aluminum chloride and aluminum sulphate in leachate treatment. The coagulation study was analysed by the author. The coagulation test was carried out to remove chemical oxygen demand, colour, total suspended solids and turbidity. Optimum coagulant dose was found as 1.9 g/L for Poly aluminum chloride, and 9.4 g/L for aluminum sulphate. The chemical oxegen demand removal was 84.50 % for aluminum suphate and 56.76 % for poly aluminum chloride. However poly aluminum chloride was efficient in removing turbidity, total suspended solids and colour.

In line coagulation method was presented by Krystyna et al. (2009). Different types of coagulant were used in this study. FeCl3, Al2(SO4)3 and Fe2(SO4)3 were used as coagulants. The in line coagulation showed the improvement in water quality. The author suggested that the choice of coagulant was important for the amount of organic matter removal. The aluminum coagulant proved its highest efficiency for organic matter removal.

Coagulant dosage optimization in leachate treatment was discussed by Talebi et al. (2009). The coagulant used was ferrous sulphate. The water quality 13

parameters like chemical oxygen demand, colour and turbidity were analysed using the ferrous sulphate coagulant. The optimization tool called response surface methodology was used to find the optimal coagulant dosage. From the response surface methodology, the coagulant dosage was found as 10 g/l. Based on the study, the coagulant ferrous sulphate was identified to be the most efficient. The authors presented the usefulness of designing experiments for optimization issues.

3. METHODOLOGY

3.1 Processes:

3.1.1 Aeration:

Aeration involves bringing air or other gases in contact with water to strip volatile substances from the liquid to the gaseous phase and to dissolve beneficial gases into the water.

The cascade type gravity aerator is used in this plant and its head is 15 m. Purpose of aeration in water treatment is to reduce the concentration of taste and odour causing substances.

3.1.2 Coagulation and Flocculation:

The process of mixing certain chemicals to water to neutralize the electrical charges and to form an insoluble, gelatinous flocculent precipitate for absorbing and entraining suspended and colloidal particles of impurities is called coagulation.

The coagulant used in this plant is alum or aluminum sulphate. Principle of coagulation can be explained by two considerations:

1. Floc formation
- When coagulants are added to water, an insoluble gelatinous precipitate is formed. This precipitate is known as the Flock.
- Flock has got the property of asserting the suspended impurities in water during its downward travel towards the bottom of tank.

2. Electric charges
- The flock positively charged attracts negatively charged clay particles and thus they cause the removal of such particles from water.

Types of coagulants

1. Aluminium sulphate or Alum.
2. Chlorinated copperas.
3. Ferrous sulphate and lime
4. Sodium aluminate.
5. Magnesium carbonate and lime.
6. Polyelectrolytes.

Dose of chemicals:

The amount of coagulants and the auxiliary chemicals which are to be added for best flock formation mainly depend on the turbidity of raw water, its pH value and standard of purity desired. The optimum dose is determines actually by conducting the practical on jar test apparatus.

Main coagulant	Auxiliary chemicals	Quantity required in mg/litre
Alum	Lime as CaO	55
	Lime as $Ca(OH)_2$	74
	Soda ash as $NaCO_3$	104
	Natural alkalinity as $CaCO_3$	99
Ferrous sulphate	Lime as CaO	44
	Lime as $Ca(OH)_2$	58
	Chlorine Cl_2	27

Table no. 1 Quantity of Auxiliary Chemicals to be used with common Coagulants.

3.1.4 Sedimentation:

When suspended matter in water is separated by the action of gravitation, the process is called plain sedimentation. Suspended particles of size 0.01mm and more and having specific gravity is greater than 400mg/lit, plain sedimentation is recommended.

3.1.5 Filtration:

Filtration is the most relied water treatment process to remove particulate material from water. Commonly used filter type in water treatment are classified on the basis of filtration rate, driving force, direction of flow. Rapid gravity sand filter are used in this plant and 6 filter bed are available for filtration of water.

3.1.6 Disinfection:

The process of killing the infective bacteria from the water and making it safe to the user is called disinfection. It does not mean total destruction of all living things in the medium treated because sterilization means total destruction. The filters are unable to remove all the disease causing bacteria in addition to the useful bacteria. Before the water is supplied to the public it is utmost necessary to kill all the disease causing bacteria. The chemicals or substances which are used for killing the bacteria are

known as Disinfectants, and the process of killing the bacteria is known as disinfection of water.

3.1.7 Clorination:

Chlorination is used in water treatment facilities primarily for disinfection. Because of chlorine's oxidizing power, it has been found to serve other useful purposes in water treatment, such as Taste and odour control; Prevention of algal growths; Maintenance of clear filter media; Removal of iron and manganese; Destruction of hydrogen sulphide; Bleaching of certain organic colours.

Table n. 2 Typical Chlorine Dosage at Water Treatment Plants

Chlorine Compound	Range of Doses
Calcium Hypochlorite	0.5-5mg/L
Sodium Hypochlorite	0.2-2mg/L
Chlorine Gas	1-16mg/L

3. CONCLUSIONS

The main objectives of this study are;

- To assess the existing performance level of water treatment plant in regard to:

1. Its ability to produce good quality water and control pathogens.
2. Effect of design, operation and administration on treatment performance.
3. Effectiveness of monitoring and technical survey.

- We have studied features of the processes of water treatment process. It is very necessary to remove the physical, chemical and biological impurities which are hazardous for the human life.
- Drinking water quality should be tested and evaluated on the basis of physical, chemical and biological parameters. Use of contaminated water can lead various diseases. The methods or techniques using for the removal of contaminants.

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