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Study on Adequacy of Functional Characteristics of a Typical Urban Waste Water Treatment Plant

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ABSTRACT

This study examines the presence of pollution of river Yamuna in the city of Delhi. The condition of river Yamuna is deteriorating day by day. The main cause of this is the poor standard treated sewage from the sewage treatment plants being dumped into drains which directly meet into river Yamuna. In this study I audited Keshopur 40 MGD sewage treatment plant which works on activated sludge process in which Mixed Liquor Suspended Solids (MLSS) is the prime concern for the proper functioning of plant and checked the adequacy of the various functional units by comparing the detention time of each and every unit with the standard detention time given by code. Activated Sludge Process involves aeration and a biological flock composed of bacteria and protozoa to convert non settle particles into the settle one.ASP provides one of the highest degree of treatment within the limited cost involved. In this study various recommendations are also given for increasing the efficiency of sewage treatment plant.

Keywords: *Activated sludge process; Sewage treatment plant; MLSS; Adequacy.*

1.0 Introduction

Delhi collects its sewage from a wide network of 7000 km of sewage lines across the city from the approved colonies, re-settlement colonies, urban villages, unauthorized-regularized colonies and unauthorized colonies. Laying of sewerage system in the unsewered areas is a crucial step for pollution abatement from river Yamuna. At present, Delhi Jal Board is supplying around 830 MGD of drinking water to population of Delhi. The sewage generated @ 80% is as per Central Public Health and Environmental Engineering Organisation (CPHEEO) norms and is estimated about 680 MGD.

There are 36 Sewage Treatment plants at 21 locations in Delhi. Municipal wastewater treatment in Delhi is undertaken through activated sludge process which is the most common suspended growth process. Activated sludge plant involves wastewater aeration in the presence of a microbial suspension, solid-liquid separation following aeration, discharge of clarified effluent, wasting of excess biomass, and return of remaining biomass to the aeration tank.

In activated sludge process wastewater containing organic matter is aerated in an aeration basin in which micro-organisms metabolize the suspended and soluble organic matter. Part of organic matter is synthesized into new cells and part is oxidized to CO_2 and water to derive energy. In activated sludge systems the new cells formed in the reaction are removed from the liquid stream in the form of a flocculent sludge in settling tanks. A part of this settled biomass, described as activated sludge is returned to the aeration tank and the remaining forms waste or excess sludge.

1.2 Objective of the study

To measure the all the functional units of keshopur 40 MGD sewage treatment plant in Delhi and compare them to the standards.

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Figure 1: Schematic Showing Activated Sludge Process Sewage Treatment Plant

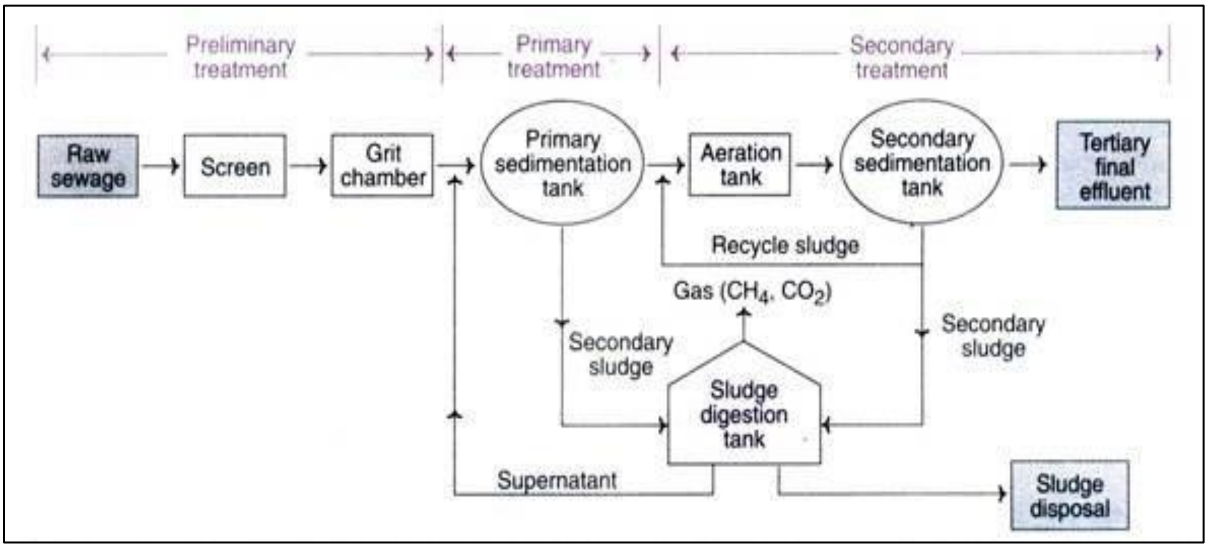
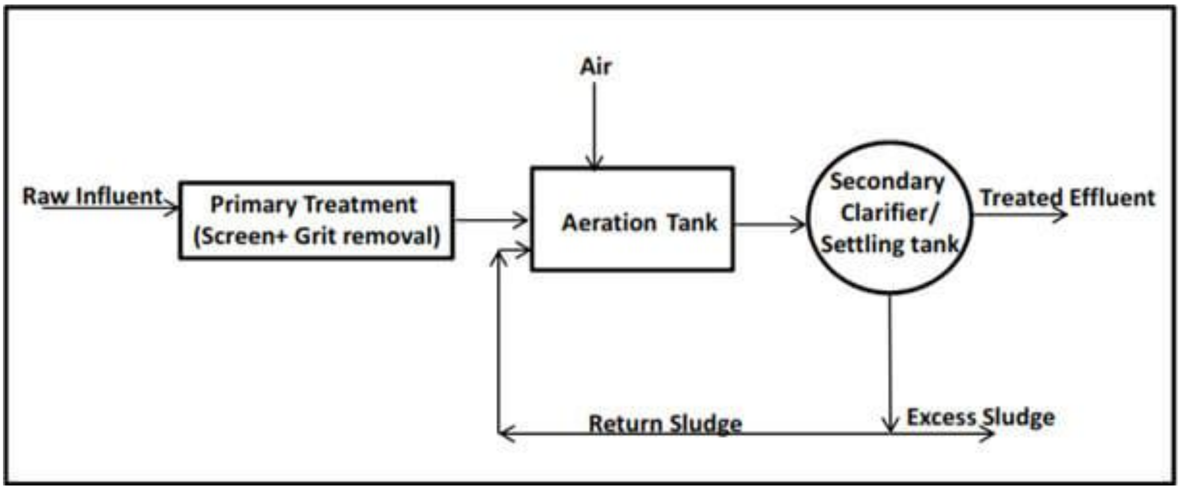


Figure 2: Schematic Showing Extended Aeration Type Sewage Treatment Plant



To give justifying recommendations for its proper functioning.

2.0 Literature Review

Dubey and Gupta, Audit Process on Water Treatment Plant [1]. In this paper they discussed the energy audit process of the 42 MLD sewage treatment plant situated in Jabalpur area at lalpur (M.P). They found that more energy is consumed in Electric motors, pumps, lighting, wastewater etc. A large amount of electrical energy is consumed in induction motor used in Industry. In this paper they describe the auditing process and various factors affecting the efficiency of any equipment and how to calculate the exact values from the electricity bills, we are discussing use of energy per day - savings measures which energy auditors frequently use.

The auditing process includes preliminary audit and detailed energy audit as-

1. Conducted meeting
2. Collected plant data
3. Conducted field investigation
4. Create Equipment Inventory
5. Follow up

Hamed and Sabzali Comparative study of SMBR and extended aeration activated sludge processes in the treatment of high-strength wastewaters [2]. This study show the comparison between performance of extended aeration activated sludge (EAAS) and submerged membrane bioreactor (SMBR) systems in the treatment of wastewater under the same condition. The chemical oxygen demand (COD) concentration of the influent wastewater for the EAAS and SMBR systems was adjusted between 500–2700 and 500–5000 mg/L, respectively. Results showed that the quality effluent produced in SMBR system is much better than EAAS system in terms of COD, biochemical oxygen demand (BOD5), total suspended solids (TSS) and ammonium. By increasing the concentration of COD, the concentration of mixed liquor suspended solids (MLSS) and the removal efficiency of organic matter in the SMBR system were increased regularly; however, the removal efficiency of COD in the EAAS system was irregular.

3.0 Materials and Methedology

3.1 Study area

This study includes the functional inspection of the Kesopur 40MGD sewage treatment plant which is situated in New Delhi and measuring the dimensions of each unit and then calculating the detention time of each unit by dividing the volume of each tank by the flow rate present at the sewage treatment plant. Then this calculated detention time is compared with standard detention time given by codes.

Date & Time	: -	20.02.2019 & 2:15pm
Capacity	: -	40 MGD
Flow rate at the plant	:-	52.9 MGD
% Utilization	:-	132.25
Latitude	: -	28.6518
Longitude	: -	77.0809
Process	: -	ASP
Guiding Person	: -	KP Tiwari
Operator	: -	DJB

3.2 Screens

- Purpose- Removal of floating material.
- Total no. of screens –3(mechanical screens)
- None of the screen was working.

Figure 3: Mechanical Screens

3.3 Degritting unit

- No. of grit chamber = 3
- Length = 12.8m
- Breadth = 13.1m
- Height = 0.95m
- Flow = 10006.916m3/hr = 166.782m3/min.
- Flow at one unit = 55.59m3/min.
- Detention time =2.86 min.
- Disposal of grit was proper.
- Grit chamber working satisfactorily.

Figure 4: Grit Chamber

3.4 Primary clarifier/PST

- No. of unit = 4
- Radius = 19.4m.
- Depth at centre = 4.8m.
- Depth at corner = 3.6m
- Average depth = 4.2m
- Volume = 4965.953m^3
- Flow = 10006.916m^3/hr
- Flow at one unit = 2501.729 m^3/hr.
- Detention time = 1.98hr.
- Some floating particles were observed in PST.

Figure 5: PST

3.5 Aeration unit

- No. of unit – 24 (13 working) +12 diffusers
- Volume – 77.4*93*6m^3
- Flow =10006.916m^3/hr.
- Detention time =4.31hr
- Sample was taken frequently to determine MLSS concentration.
- Diffused aeration system + mechanical aerators
- Colour of return sludge not dark brown.
- MLSS was very low = 740mg/l.(MLSS should be between 1500-3000mg/l)

Figure 6: Aeration Tank

3.6 Secondary sedimentation tank

- No. of unit :- 4
- Radius :- 23m
- Depth at centre :- 5.3m
- Depth at corner :- 3.5m
- Average depth :- 4.4m
- Volume :-7312.37 m^3
- Flow :- 10006.916m^3/hr
- Flow at one unit :- 2501.729 m^3/hr.
- Detention time :- 2.92hr.

Figure 7: Final Sedimentation Tank

3.7 Sludge drying beds

- No. of beds :- 46
- Floating material observed in drying beds.

Figure 8: Sludge Drying

3.8 Sludge digestors

- No. of unit = 10.

3.9 Gas Holders

- No. of unit = 3
- Total gas compressors = 20
- All Gas formed was flared.

Figure 10: Gas Holder

4.0 Results and Analysis

Type of Unit	Measured/ Calculated Values	Theoretical Recommended Values	Remarks
Screens	Bar spacing – 20mm Mechanical screens – 3 Manual screens – 0	Spacing : 20mm	All screens were not working .
Grit Chamber	Length-12.8m Breadth-13.1m Height-0.95m Discharge-166.782m^3/min. Flow at one unit - 55.59 m^3/min. Detention time-2.86min.	Detention time-40-60 seconds	Detention time is too high.
Primary Sedimentation Tank	Diameter- 39m Depth- 4.2m Discharge-10006.916m3/hr. Flowat one unit - 2501.729 m3/hr Detention time-1.98hrs	Detention time-1.5hr – 3hr	Detention time is withing the limits.
Aeration Tank	Length- 77.4m Breadth- 93m Depth- 6m Detention time-4.31hr MLSS -740mg/l	Detention time-4-8hrs MLSS – 1500mg/l to 3000mg/l	Detention time is upto the mark and Sample was taken frequently for measuring MLSS concentration
Final Sedimentation Tank	Diameter- 46m Depth- 4.4m Discharge-10006.916m3/hr. Flowat one unit - 2501.729 m3/hr Detention time-2.92hrs	Depth-3.5-4.5m Detention time-2-4hrs	Detention time is within the range.

5.0 Conclusions

The conclusions drawn from the present study were

- Screens should be made operational as this is the first unit of the STP responsible for the removal of floating particles in the sewage.
- Discharge should be increased to reduce the detention time in the grit chamber.
- Detention time of the primary sedimentation tank was within the limit.
- Detention time of aeration tank was also within the limits but the MLSS was too low for the proper functioning of the plants. So, the percentage of sludge from the FST should be increased to the aeration tank.
- Detention time of the final sedimentation tank was also within the range.
  Thus, Screens should be made operational as floating particles were observed in almost all units. MLSS is too low therefore the quantity of sludge from FST that is to be transferred to inlet or at the aeration tank should be increased. Aesthetic view of plant should be enhanced. Gas generated should be used in electricity generation. Complete Rehabilitation is required which includes high design parameters, sludge management and power generation.

References

[1] http://www.wefnet.org/MOPNEW/Operation_of_Municipal_Wastewater_Treatment_Plants/Chapter 22 Revised_6th Edition.pdf

[2] A Barwal, R Chaudhary. To study the performance of biocarriers in moving bed biofilm reactor (MBBR) technology and kinetics of biofilm for retrofitting the existing aerobic treatment systems: a review. Reviews in Environmental Science and Bio/ Technology.

[3] B Dubey, B Gupta. Audit Process on Water Treatment Plant.

[4] SJ Burrian. The Historical Development of Wet-Weather Flow Management. US Environmental Protection Agency (EPA). National Risk Management Research Laboratory, Cincinnati, OH. Document No. EPA/600/JA-99/275, 1999.

[5] GA Burton, RE Pitt, Robert. *Chapter 2. Receiving Water Uses, Impairments, and Sources of Stormwater Pollutants*. Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers. New York: CRC/Lewis Publishers. *ISBN 978-0-87371-924-7, 2001*.

[6] Chapter 3. Biological Treatment Processes. *Emerging Technologies for Wastewater Treatment and In-Plant Wet Weather Management* (Report). EPA. March 2013. EPA 832-R-12-011.

[7] Chapter 3. Flow Equalization. *Process Design Manual for Upgrading Existing Wastewater Treatment Plants* (Report). EPA. October 1971.

[8] EPA. Washington, DC . Primer for Municipal Waste water Treatment Systems. Document no. EPA 832-R-04-001, 2004.

[9] Huber Company, Berching, Germany. Sedimentation Tanks. Archived 2012-01-18 at the Wayback Machine , 2012

[10] *SM Khopkar*. Environmental Pollution Monitoring And Control. *New Delhi: New Age International. p. 299.* ISBN 978-81-224-1507-0, 2004.

[11] Sanitation Systems – Sanitation Technologies – Activated sludge. *SSWM. 27 April 2018. G Tchobanoglous, FL Burton, HD Stensel. Metcalf & Eddy, Inc.* Wastewater Engineering: Treatment and Reuse *(4th ed.). McGraw-Hill.* ISBN 978-0-07-112250-4, 2003.