

Performance Evaluation Sewage Treatment Plant (115 Mld Naidu Stp) At Pune

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ABSTRACT: This study is to be carried out to evaluating the performance efficiency of a 115 MLD sewage treatment plant situated near Dr. Naidu Hospital, Pune. The purpose is to study sewage parameters. This study is essential as the treated effluent is discharged into Mula-Mutha River. Wastewater samples were collected from influent, Aeration Tank and effluent of sewage treatment plant and analyzed for the parameters such as pH, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorous (TP), Mixed Liquor Suspended Solids (MLSS) and Sludge Volume Index (SVI). These results were useful in identification and alteration of operational and maintenance problems in the plant. To investigate how different parameters affect the mean and variance of a process performance characteristics.

KEYWORDS: Waste water treatment plant, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solid Biological treatment, Removal efficiency.

I. INTRODUCTION

Rapid growth of industries has enhanced the productivity, but resulted in the production and release of various types of polluting substances into the nature. Out of those, a significant part of this waste will end up as wastewater. An identifying of the nature of wastewater is superfluous for the design of appropriate wastewater treatment plants and the selection of effective treatment process/technologies. The aim of wastewater treatment is to be disposed safely, without being damage to public health and without changing the nature of water bodies. The Major source of municipal sewage is 99 % water carrying domestic wastes.

Poorly treated wastewater with high levels of pollutants caused by poor design, operation or maintenance of treatment systems creates major environmental issues, when such wastewater is discharged to natural streams. Such problems includes contamination and deoxygenation of streams and waterways by direct discharge or run off of inadequately treated wastewater, Excessive concentration of nutrients such as nitrogen and phosphorous in surface and subsurface water bodies. This contributes to excessive growth of algae, plants and blooms, which pollute downstream water makes unfit for domestic, agriculture and industrial use. It is carried out various problems like land degradation and damage to pastures and crops. Long term damage to soil productivity due to excessive nutrient loading, High salinity, Low / High pH, over application of wastewater to land resulting in contaminated ground water, Soil structure decline due to wastewater with high Sodium Adsorption Ratio, Clogging of soil by fats / solids from irrigated wastewater [5].

1.1 WASTEWATER TREATMENT FACILITIES IN THE PUNE CITY

Pune city have 10 number of existing STP'S with total treatment capacity is 565 MLD. Plants and its capacity are tabulated in Table No. 1.1. Flow chart of new naidu wastewater treatment plant is shown in fig No. 1.

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Table No. 1.1 Pune city STP with its Capacity

Sr. No.	Name of STP	Capacity (MLD)	Sr. No.	Name of STP	Capacity (MLD)
1	Naidu (Old)	90	6	Vitthalwadi	32
2	Naidu (New)	115	7	Bhairoba	130
3	Tanajiwadi	17	8	Mundhawa	45
4	Erandwane	50	9	Kharadi	40
5	Bopodi	18	10	Baner	30

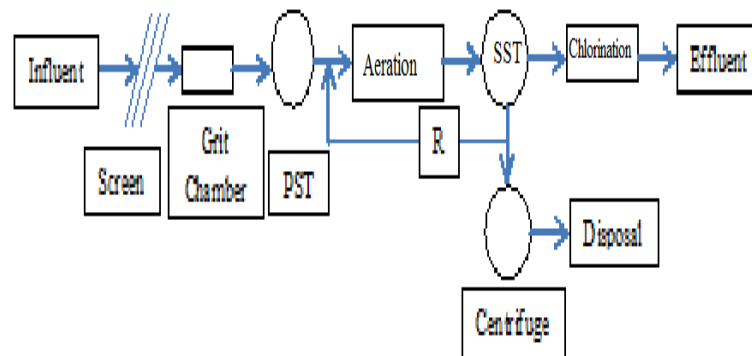


Fig No.1 Schematic Diagram of New Naidu Sewage Treatment Plant

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Fig No.2 Google image of STP Site

1.2 OBJECTIVES OF THE STUDY

The study was conducted with the following major objectives at Dr. Naidu wastewater treatment plant.

1. To study and define the location of sampling which highly contributed in performance evaluation of STP.
2. To study the parameter of wastewater such as pH, BOD, COD, DO TSS, Total Nitrogen, Total Phosphorous, MLSS and SVI
3. To investigate relationship between various parameters which are related with performance of STP performance through Statistical Analysis.
4. To study and develop a mathematical model to predict the important parameters.

II. MATERIALS AND METHODOLOGY

2.1 WASTEWATER TREATMENT PLANT: AN OVERVIEW OF EXISTING STP

Overall methodology adopted for objects evaluations is shown in figure no. 2. Wastewater samples were collected from the influent, aeration tank and effluent of the sewage treatment plant. Samples have been collected 3 months from 15th December 2016 to 14th March 2017. Collected samples were analysed for the important parameters pH, BOD, COD, TSS, TN, TP, MLSS and SVI. The results which are obtained after analysing samples from raw influent and treated effluent of STP are compared with standard parameter of CPCB.

Specifications of Plant

Naidu wastewater treatment plant working process is Conventional Activated Sludge Process. This plant is receiving sewage from Kasba Peth and Tophakhana Pumping Station. Hydraulic design unit are tabulated in Table No. 2
Total average flow = 115 MLD, Peak factor = 2,
Design flow = 230 MLD.

Table No. 2 Hydraulic Design Details of plant

Sr. No.	Description	Dimension	Nos.
1	Inlet Chamber	8.20 x 6.10 x 3.20 m	01
2	Screen Channel	1.60 x 6.00 x 1.00 m	04
3	Grit Chamber	1.24 x 1.24 x 0.94 m	02
4	PST	32.70 m Dia. X 3.50 m	04
5	Aeration Tank	40.33 x 26.30 x 5.00 m	04
6	SST	46.00 m Dia. X 2.50 m	04
7	Chlorine Contact Tank	40.00 x 20.00 x 0.32 m	01

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2.2 SAMPLING SCHEDULE AND FREQUENCY:

Grab sampling method were used for sample collection from STP at the sampling points. Samples were collected weekly in plastic bottles and analyzed for the various parameters like pH, BOD, COD, TSS, TN & TP etc as per the procedures laid down in standard methods for the examination of water and wastewater (1979).[3]

III. OBSERVATION AND RESULT

Samples were collected from sampling point and tested in the laboratory. Based on the laboratory analysis, the influent and effluent result of all the parameters have been identified through which variation in wastewater parameters and the removal efficiency of each parameter have been calculated.

Test observations of wastewater quality parameters are studied. The characteristics of sewage before and after treatment with tolerance limits are shown in fig 3. The pH values of treated outlet observed in between 7 to 7.61 which are within the permissible limits. BOD values of treated outlet are in between 7 to 10. Minimum COD value of treated outlet is 10 and maximum value is 20. Minimum TSS value of treated outlet is 7 and maximum value is 10. Minimum TN value of treated outlet is 1.2 and maximum value is 1.9. Minimum TP value of treated outlet is 0.8 and maximum value is 1.3. Sludge Volume Index (SVI) is a very important indicator for biological treatment unit, that determines your control or rate of desludging on how much sludge is to be returned to the aeration basin and how much to take it out from the system. SVI is a key factor when it comes to the clarifier design so that a clear wastewater discharge can be obtained without significant carry over of sludge. SVI and MLSS value found to be in the range between 2332-2810 and 62-75 respectively. Typically a healthy sludge aeration pond basin should have the value registered within 80 to 150 ml/g and the MLSS concentration between 3000 – 5000 ppm with the wastewater temperature less than 20 and An SVI of 80 or less usually indicates a sludge that is dense and has rapid settling characteristics that’s mean normal operation; good settling; low effluent turbidity.

Percentage treatment efficiency of STP is shown in fig no.4. Maximum BOD removal efficiency is 90.70% and Minimum BOD removal efficiency is 84.44%. COD removal efficiencies of STP are maximum removal efficiency is 91.33% and minimum removal efficiency is 85%. Total Suspended Solid removal efficiencies are maximum removal efficiency is 89.03%. Minimum removal efficiency is 78.13%. Total Nitrogen removal efficiencies are maximum removal efficiency is 82.61%. Minimum removal efficiency is 72.46%. Total Phosphorous removal efficiencies are maximum removal efficiency is 80.95%. Minimum removal efficiency is 70.45%. The overall treatment showed good performance. Every treatment phase of this STP has its unique removal capacity and the treated water of STP met the effluent discharged standards.

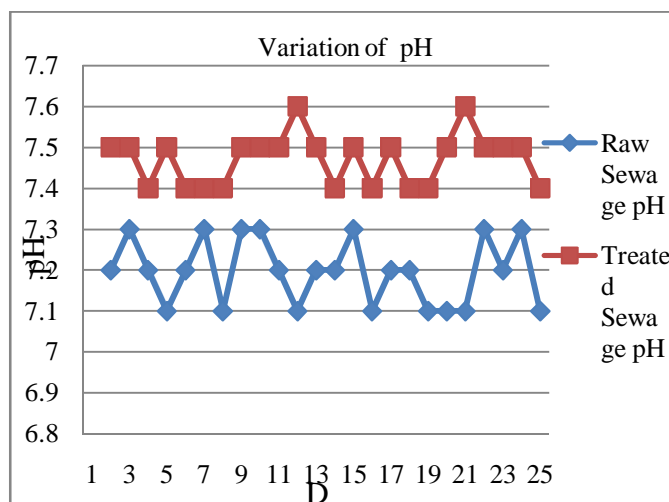


Fig No. 3a Variation of pH

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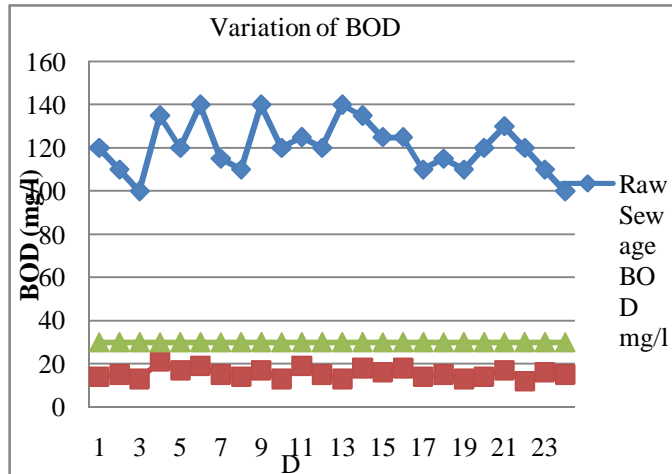


Fig No. 3b Variation of BOD

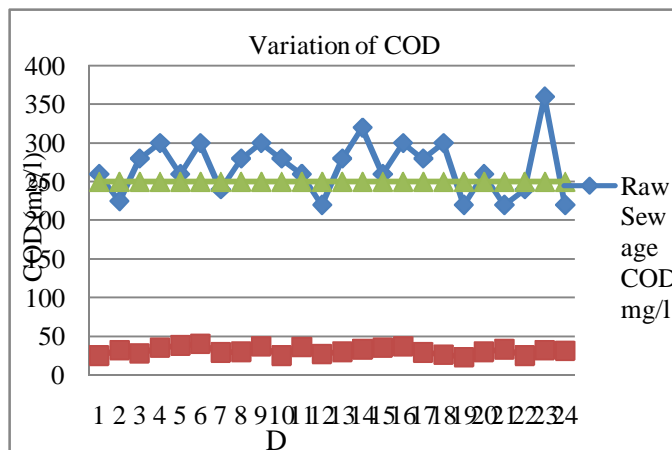


Fig No. 3c Variation of COD

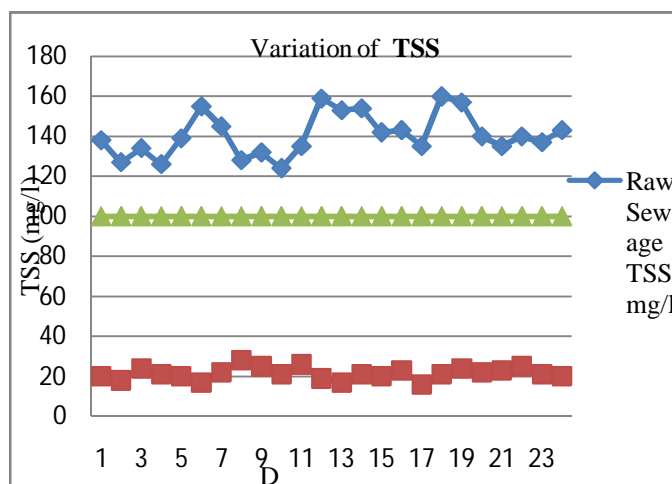


Fig No. 3d Variation of Total Suspended Solids.

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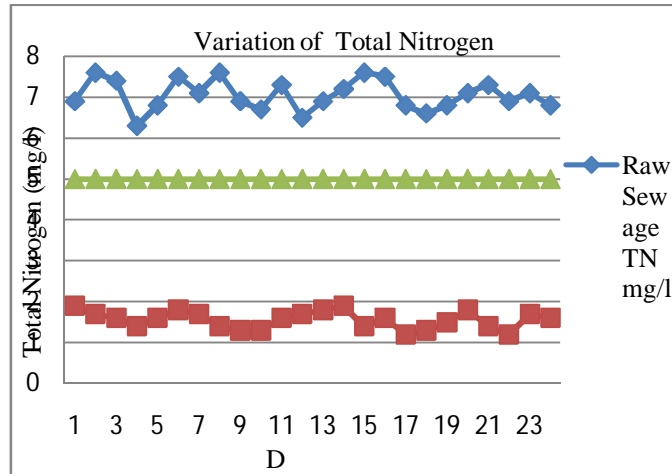


Fig No. 3e Variation of Total Nitrogen.

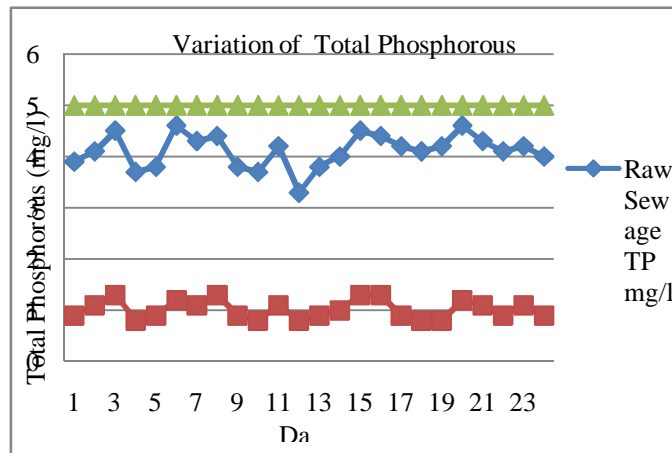


Fig No. 3f Variation of Total Phosphorous.

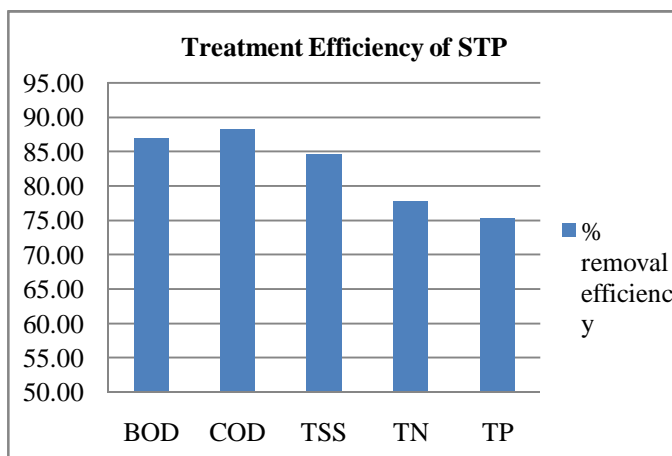


Fig No. 4 Percentage treatment efficiency of STP

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Statistical Analysis

Preliminary data analysis is carried out by using correlation matrices. Results of correlation matrices give us the set of parameters which are affecting the efficiency of sewage treatment plant. Correlation matrices show that MLSS, SVI, COD, BOD and TSS are related to the efficiency of sewage treatment plant. As a next step, Regression analysis is carried out to relate effluent BOD, COD and TSS with MLSS and SVI. Regression analysis is used to determine the correlation between effluent BOD, COD and TSS with MLSS and SVI of wastewater using the plant data. The result of regression analysis gives set of equation for each parameter. From this equation we can predict the outlet values of the BOD, COD and TSS if we know the values of MLSS and SVI in the aeration tank.

IV. CONCLUSION

Bases on the laboratory analysis and the operating data of sewage treatment plant, it is concluded that,

- TSS - TSS removal efficiency is found to be 89.03% and 78.12%. Average TSS removal efficiency of the plant is 84.67%.
- BOD - Maximum and minimum BOD removal efficiency is found to be 90.71% and 84.44%. Average BOD removal efficiency of the plant is 87.09%.
- COD - Maximum and minimum COD removal efficiency is found to be 91.33% and 85%. Average COD removal efficiency of the plant is 88.33%.
- TN - TN removal efficiency is found to be 82.6% and 72.46%. Average TN removal efficiency of the plant is 77.88%.
- TP - Maximum and minimum TP removal efficiency is found to be 80% and 70%. Average TP removal efficiency of the plant is 75.40%.
- The above laboratory analysis results suggest that the plant is operating satisfactorily and treated wastewater can be used for irrigation purpose and can be discharged in natural stream.
- Correlation analysis showed correlation between MLSS, SVI, COD, BOD and TSS. Hence predictions equations are formulated by using regression analysis.
- By using equations obtained from regression analysis we can predict the values of important parameters at outlet of STP and this model can be applied to other projects also.
- Design of primary and secondary clarifier is compared as per CPHEEO manual. Diameter of the clarifier is matched as actual and calculated by using CPHEEO manual.

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