PERFORMANCE EVALUATION OF STP (300KLD CAPACITY) FOR THE TREATMENT OF DOMESTIC WASTE WATER

Mrs. KAVYA MPM (1)

1 Assistant Professor Civil Engineering Department, Rajarajeswari College of Engineering, Bengaluru, Karnataka.

ABSTRACT

Bengaluru's urbanization trend is putting pressure on local government agencies to supply necessities like infrastructure, clean drinking water, and sanitary facilities. The need for portable water has increased due to the population's rapid rise, necessitating the development of distribution and purification systems as well as the exploration of raw water sources. The foundation of the study is environmental engineering. Throughout the project, the RRD residential sewage treatment plant in Bengaluru's efficiency would be improved. pH, Turbidity, TSS, COD, and BOD are the parameters that have been chosen. Every Thursday and Friday, for a period of five days, the treated and untreated samples will be collected and evaluated in the RRCE laboratory. To assess the plant's efficiency, results from collected samples are compared with BIS and GPCB standards. Additionally, the activated sludge plant's removal efficiency will be computed. Therefore, action against untreated water might be taken to save the ecosystem. Furthermore, the operational and maintenance issues of the wastewater treatment facility are examined, and appropriate recommendations have been made to address these issues and support the RRD organization in efficiently repurposing sewage water.

Key words: *Sewage Treatment Plant, Biochemical Oxygen Demand, Chemical Oxygen Demand, Dissolved Oxygen, pH.*

1. INTRODUCTION

The sweepers have been gathering, transporting, and manually disposing of a society's waste materials—including human excreta—to a secure location for eons. The outdated technique of gathering and discarding rubbish from society has been replaced with a more advanced system that involves mixing waste with enough water and allowing it to flow through closed tubes under gravity. Wastewater, often known as sewage, is a mixture of water and waste materials that naturally flows to a location where it is disposed of after receiving the appropriate treatment. This eliminates the need to carry waste on heads or carts. The cleaned sewage effluents can be utilized to irrigate crops or dumped in a stream or other body of moving water.

Sewage types: Domestic sewage is made up of liquid waste from restrooms, showers, kitchen sinks, laundry rooms, and other fixtures in homes, businesses, or institutions. Because it contains human excrement, this sewage is typically exceedingly filthy.

When human excreta (pee and feces) is gathered using flush toilets, it is referred to as black water. This mixture is frequently combined with used toilet paper or wipes. Known as grey water or sullage, washing water (personal, clothes, floors, dishes, cars, etc.) Domestically produced excess liquids (drinks, cooking oil, insecticides, lubricating oil, paint, cleaning solutions, etc.) Rainfall runoff from urban areas collected on roads, parking lots, roofs, walkways, and pavements (which may include oils, animal waste, litter, fuel, diesel, tire rubber residues, soap scum, metals from vehicle exhausts, etc.), drainage from highways (oil, deicing chemicals, rubber leftovers, especially from tires), storm drains (which might hold garbage), artificial liquids (pesticides, used oil, etc. that are illegally disposed of) Liquid wastes from the industrial processes of many different industries, including brewing, papermaking, dyeing, and so on, make up industrial sewage. The kind of industry and the chemicals employed in their process waters have a major impact on the quality of their industrial sewage. They can occasionally be

extremely smelly and need to be well cleaned before being dumped in public drains. drainage from industrial sites (silt, sand, oil, alkali, and chemical wastes);
Industrial cooling waters with heat, slimes, silt, and biocides waters used in industrial processes, Waste that is organic or biodegradable, such as that from creameries, ice cream factories, and slaughterhouses; also includes non-organic waste (such pesticide or pharmaceutical manufacturing). difficult-to-treat/biodegradable waste
extreme pH waste (from metal plating, acid/alkali production), toxic waste, such as pesticide manufacturing, cyanide synthesis, and metal plating.
Solids and emulsions (foodstuffs, lubricating and hydraulic oil production, paper making, etc.), Direct and diffuse agricultural drainage, Fracking by hydraulic means, created water through the extraction of natural gas and oil.

Parts of the sewer system:
A sewerage system is made up of a network of sewer pipes that are installed to transport waste from houses to a facility that treats it. House sewers (or individual house connections), lateral sewers, branch sewers (or sub mains), main sewers (sometimes referred to as trunk sewers), and outfalls may be included in this sewage network. Because there are insufficient water sources in India and intense rainstorms that last for three months or longer, the ratio of "sewage" to "drainage" can be as high as 20 to 30. Therefore, if the combined system is implemented, only 1/20th or 1/30th of the intended discharge will be flowing down the sewers during non-monsoon times.

Sewer (that is, the pipeline that carries waste to the treatment facility); etc. Every sewer line has a manhole at the appropriate intervals to make cleaning and inspection easier. To allow storm water from street gutters to enter the sewers, which transport the drainage discharge either exclusively or in conjunction with sewage, inlets known as catch basins are installed.
The initial contaminated sewage cannot be directly dumped into water sources in order to prevent widespread pollution and maintain the water sources' use for downstream populations. a whole course of therapy that includes screening. Activated sludge, biological filtration, or sedimentation

2. SCOPE OF THE STUDY

The problem of the management of the domestic waste water, at a global level, around 80% of wastewater produced is discharged into the environment untreated, causing widespread water pollution.
There are numerous processes that can be used to clean up wastewaters depending on the type and extent of contamination. Wastewater can be treated in wastewater treatment plants which include physical, chemical and biological treatment processes. Municipal wastewater is treated in sewage treatment plants (which may also be referred to as wastewater treatment plants). Agricultural wastewater may be treated in agricultural wastewater treatment processes, whereas industrial wastewater is treated in industrial wastewater treatment processes.
One type of aerobic treatment system is the activated sludge process, based on the maintenance and recirculation of a complex biomass composed of microorganisms able to absorb and adsorb the organic matter carried in the wastewater. Anaerobic wastewater treatment processes are also widely applied in the treatment of industrial wastewaters and biological sludge. Some wastewater may be highly treated and reused as reclaimed water. Constructed wetlands are also being used.

- To recycle and reuse waste water.
- The index value of different parameter can be analyzed.
- To propose set of recommendations of up gradation.
- The daily sample calculation and stability analysis by comparing with the index value.
- Monitoring and operating STP.

3. PROJECT OBJECTIVE

1. To determine the characteristics of waste water discharged from RRMH canteen and hostel.
2. To evaluate the performance of Sewage treatment plant (STP) in line with the regulatory stipulation.
3. To evaluate the performance of each unit process of sewage treatment plant.
4. Data analysis and interpretation to explore the bottle need.
5. Recommend the steps to improve upon the performance.

4. METHODOLOGY

DETAILS OF THE STUDY AREA AND DETAILS OF STP

The Bangalore Water Supply and Sewerage Board (BWSSB) proposed to set up an integrated municipal sewage waste management facility at Rajarajeswari Medical College and Hospital which is 23 km from Bangalore with a capacity to handle 300 KLD per day of sewage waste generated in the Rajarajeswari Medical College and Hospital campus, Mysore road, Bangalore. In the view of temperature conditions larger industries including electronics and computers have come up in city and outskirts. The industrial growth has resulted in increase in population and subsequently increasing in generation of sewage waste. Bangalore urban and rural districts are located in the southeastern part of Karnataka state between the north latitude 13°04' and 13°06' and east longitude 77°43' and 77°45'. The two divisions of Bangalore district came to existence during 1986 with division of Bangalore urban and rural. The geographical area of these districts covering about 8062 sq.Km is bound by Kolar or Tumkur districts in the east and north, by Mandya districts to the west and towards southeast by Tamilnadu state. The Bangalore rural district covers an area of 5814 Sq.Km and Bangalore urban district covering an area of 2208 sq.km.

WORKING PROCEDURE

1. COLLECTION OF SAMPLE BY GRAB SAMPLING

The physical and chemical characteristics of sewage vary from depth as well as with time as from morning to evening. It therefore becomes difficult to obtain a truly representative sample therefore samples are taken at a point beneath the surface where the turbulence is thoroughly mixing up the sewage particles. This is called a grab sample. Such grab samples are collected at regular intervals during a day. These different samples are now mixed together, and the amount utilized from each specimen was collected. This composite sample is taken for testing, as it represents more nearly, the true strength of the sewage.

2. DESIGN AND DETAILS OF VARIOUS UNITS OF WASTE WATER TREATMENT

Inlet
The inlet water is the pure waste water consisting of the domestic waste generated from the hostel and canteens which include toilets, bathrooms, vegetable and fruits skins, soap foams, scum etc.

Screening chamber
Screening is the first operation used at wastewater treatment plants (WWTPs). Screening removes objects like rags, paper, plastics, and metals to prevent damage and clogging of downstream equipment, piping, and appurtenances. Some modern wastewater treatment plants use both coarse screens and fine screens.
There are 2 bar screen chambers; one with dimension 1.4x1.5x1.6 m of capacity 0.42cum and another with dimension 0.6x1.5x0.6 m of capacity 0.54cum

Pumping
The wastewater system relies on the force of gravity to move sewage from your home to the treatment plant. So wastewater-treatment plants are located on low ground, often near a river into which treated water can be released. If the plant is built above the ground level, the wastewater has to be pumped up to the aeration tanks. From here on, gravity takes over to move the wastewater through the treatment process.

Oil and grease trap

When the waste water outflow enters the grease trap, the solid food particles sink to the bottom while the lighter grease and oil floats to the top. Dimension of oil skimmer tank is 4.6 x 1.4 x 1.0 m using belt type.

Holding Cum Equalisation Tank

Equalization tank for wastewater treatment refers to a holding tank that allows for equalization of flow. An equalization tank may also be used as a staging area where chemicals, activated sludge, or other agents are added into the wastewater treatment process.

Filtration

Sand filtration removes much of the residual suspended matter. Filtration over activated carbon, also called carbon adsorption, removes residual toxins. The secondary settling tank of dimension 4.5 x 4.5 x 2.7 m.

Surface-aerated basins (Lagoons)

Many small municipal sewage systems in use aerated lagoons. Most biological oxidation processes for treating industrial wastewaters have in common the use of oxygen (or air) and microbial action. Surface-aerated basins achieve 80 to 90 percent removal of BOD with retention times of 1 to 10 days. The basins may range in depth from 1.5 to 5.0. meters and use motor-driven aerators floating on the surface of the wastewater.

Analysis of parameters

The samples were collected at various stages as mentioned above and brought to the environmental lab and the following parameters were analyzed.
PHYSICAL CHARACTERISTICS

1. pH
2. COD
3. Total suspended solids (TSS)
4. BOD
5. Turbidity

CHEMICAL CHARACTERISTICS
1. Inorganic chemicals
2. Organic chemicals
3. Chemical Oxygen Demand
4. Biochemical Oxygen Demand

5. RESULT AND DISCUSSION

1st sample analysis
The samples were collected on 9th march 2024 from RRDCH STP of capacity 300 KLD.
A sunny weather condition was reported on the day at 12.15pm.
Analysing of sample on day 1

Parameters	S1 (Inlet)	S2 (After ET)	S3 (After SST)	S4 (With CL)	S5 (Without CL)
pH	7.82	7.06	7.63	7.85	8.06
COD	196	132	152	180	84
BOD	12.54	-	-	-	5.86
TSS	1200	1250	600	600	-
Turbidity	-	-	34	17	10

2nd sample analysis
The samples were collected on 16th march 2024 DCH STP of capacity 300 KLD. A sunny weather condition was reported on the day at 11 am.
Analyzing of sample on day 2

Parameters	S1 (Inlet)	S2 (After ET)	S3 (After SST)	S4 (With CL)	S5 (Without CL)
pH	7.89	7.07	7.55	7.63	8.04
COD	100	40	52	24	80
BOD	13.23	-	-	-	6.59
TSS	60	500	400	250	-
Turbidity	41	65	08	06	11

3rd sample analysis

The samples were collected on 23rd march 2024 DCH STP of capacity 300 KLD. A cloudy weather condition was reported on the day at 10 am.
Analyzing of sample on day 3

Parameters	S1 (Inlet)	S2 (After ET)	S3 (After SST)	S4 (With CL)	S5 (Without CL)
pH	8.28	8.06	8.06	8.14	8.07
COD	136	128	80	60	90
BOD	16.23	-	-	-	9.54
TSS	600	450	900	650	-
Turbidity	42	36	04	07	20

4th experimental day
The samples were collected on 30th march 2024 DCH STP of capacity 300 KLD. A sunny weather condition was reported on the day at 11 am.
Analyzing of sample on day 4

Parameters	S1 (Inlet)	S2 (After ET)	S3 (After SST)	S4 (With CL)	S5 (Without CL)
pH	8.01	7.84	7.55	7.96	8.00
COD	140	72	128	176	76
BOD	14.46	-	-	-	8.6
TSS	1150	1150	650	650	-
Turbidity	59	37	04	04	09

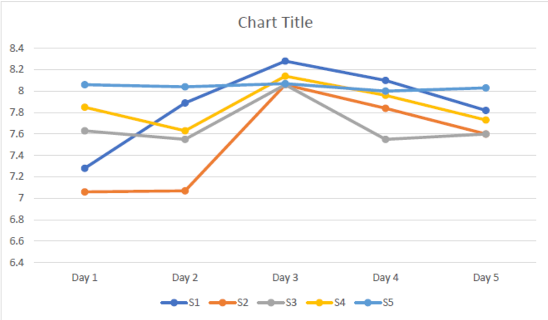
5th experimental day
The samples were collected on 6th April 2024 from RRDCH STP of capacity 300 KLD. A sunny weather condition was reported on the day at 11 am.
Analyzing of sample on day 5

Parameters	S1 (Inlet)	S2 (After ET)	S3 (After SST)	S4 (With CL)	S5 (Without CL)
pH	7.82	7.60	7.60	7.76	8.03
COD	152	84	123	178	89
BOD	11.95	-	-	-	7.98
TSS	750	500	350	200	-
Turbidity	49	37	09	08	10

Characteristics of parameters comparing with KSPCB Standards:

Sl. No	Characteristic	Result	KSPCB Tolerance limits
1	pH	7	6.529
2	COD	35	< 50
3	BOD	5.86	< 10
4	TSS	10	< 20
5	Turbidity	6	< 2

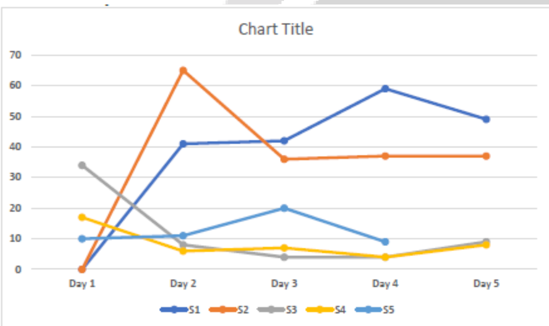
COMPARISSION OF PHYSICAL PARAMETERS OF SAMPLES



1. pH

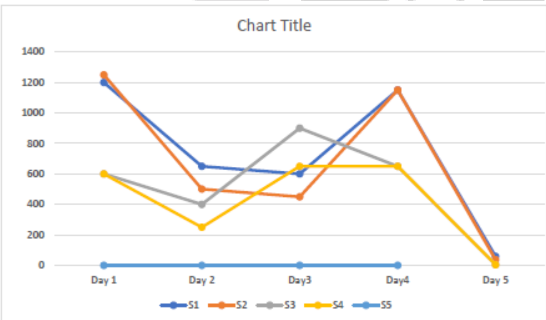
Graph of pH values for different samples collected in 5 days.
Samples from various units were collected for a period of 5 days to calculate pH. From the graph above we can conclude that, pH values of samples in the range 7.03 8.28. The highest value for pH is tabulated on 3rd day in sample 1 (S1) which is equal to 8.28.. The least value of pH i.e. 7.03 is observed in sample 7 (return sludge) on the same day. Ph at Intel is high and goes and less at final tank. This implies that, there is some problem in operation and anaerobic actives take place.

2. Turbidity



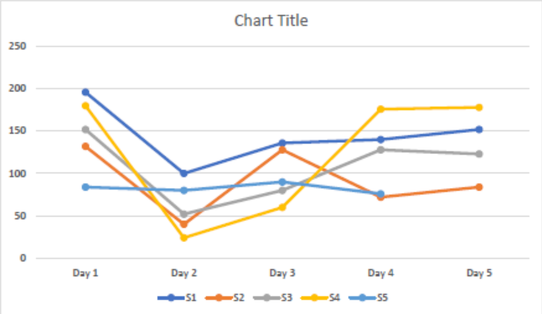
Graph of turbidity values for different samples collected in 5days
The highest turbidity value (317) is found in sample 7 (S7) i.e. return sludge. This implies that return sludge is more turbid i.e it is more opaque and dark brown in colour. This sample is fed back for recirculation.

3. TSS



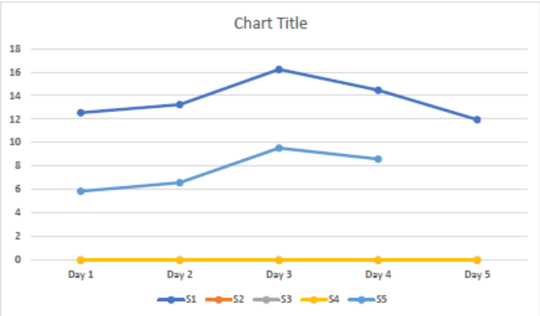
Graph of TSS values for different samples collected in 5 days.
To calculate the total suspended solids, various samples were collected. From figure 4.4, it is clear that TSS value of Sample 7 is highest as compared to others. This is because S7 has greater amount of suspended solids.

4. COD



Graph of COD Values for different samples collected in 5 days.
Above graph shows that COD of S1 is highest, because there is much food for bacteria in the sample. COD is least in S6 because most of the food is utilized by the bacteria by the time it reaches final tank.

5. BOD



Graph of BOD Values for different samples collected in 5 days.
Above graph shows that BOD of S1 is highest, because there is much food for bacteria in the sample. BOD is least in S6 because most of the food is utilized by the bacteria by the time it reaches final tank

CONCLUSIONS

1. The pH and turbidity at the initial stage were found to be high, after treating the pH is maintained to the desired limits.
2. The total suspended solids and dissolved solids were more in the return sludge which implies that the treatment unit is effective in removing the organic and inorganic matters from the waste water.
3. Residual chlorine in the collecting tank was maintained to the standards.
4. COD at the initial stage is found to be high, but after treating through various units the COD is decreased.
5. The initial value of DO is zero due to the presence of enormous amount of oraganic matter after the removal of organic matter DO increase to mg/L.
6. BOD is initially high after the biological treatment BOD decreases and Do increases.
7. From the above observations, we can clarify that the STP Unit at RRDCH of capacity 300 KLD is working satisfactorily

REFERENCES

Kavita N. et.al, "To evaluate the performance of sewage treatment plant: A case study", IRJET, Volume: 02 Issue: 08, Nov-2015.

1. 2.Ms.S. Ramya, et.al, "design of sewage treatment plant and characterization of sewage", IJCE-NCRACCESS-ISSN: 2348-8352, 2015
2. 3.Prachi N, et.al, "performance evaluation of 25MLD sewage treatment plant (STP) at kalyan", AJER, 2014.

3. 4.Dapinder Deep Singh, et.al, "Study The Different Parameters of Sewage Treatment With UASB & SBR Technologies", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), Volume-03, Issue-03, Mar-Apr 2013.
4. Ram Kumar Kushwah, et.al, "characteristics of waste water in sewage treatment plant of Bhopal, (India)", journal of chemical and pharmaceutical research, 2011.
5. 6.Ravi Kumar, et.al, "Assessment of the efficiency of sewage treatment plants: a comparative study between Nagasandra and Mailasandra sewage treatment plants", Kathmandu university journal of science, engineering and technology, November, 2010.
6. 7.Metcalf and Eddy 2003, Waste Water Engineering Treatment and Reuse, 4th Edition, Tata McGraw Hill Edition, Tata McGraw Publishing Co LTd.