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Performance Evaluation of Sewage Treatment Plant: A Review

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Abstract - *Reducing or eliminating the amount of contaminants in sewage water is the main objective of treatment. This investigation was required to evaluate how well a sewage treatment facility reduced pollution levels in order to meet regulatory environmental requirements. In order to safeguard public health, land and water supplies, and irrigation techniques, wastewater re-use must adhere to regulations and indicators must be regularly monitored and impended. For this reason, requirements must be given high priority during the evaluation and development stages. The removal efficiency of treatment facilities was regulated using chemical and biological methods. This paper assesses and examines the effectiveness and performance of the Vidyaranyapuram sewage treatment plant (STP) in Mysore. Regular monitoring of water quality is necessary in wastewater treatment plants. The present investigation will support the treatment center's endeavors to improve the therapeutic process. Since the evaluation explains the variety of water quality indicators in waste water facilities, one would be able to update the effluent efficiency standards based on seasonal fluctuations in wastewater treatment. Finding, fixing, and maintaining plant operating and maintenance difficulties is made much easier by the analytical results that were collected; these findings may be used when planning the future plant expansion to ensure successful outcomes.*

Key Words: **Wastewater Treatment, Efficiency, Mysore, Performance, Evaluation, Sewage Treatment Plant**

1. INTRODUCTION

In order to comply with tighter wastewater disposal regulations, sewage treatment plants now have additional challenges. Freshwater scarcity is a global concern that has surfaced in the twenty-first century and is no longer confined to Mysuru. It will see the beginning of the world's water catastrophe. Toxin removal and the preservation of our natural water supplies are among the overarching goals of sewage treatment with regard to water conservation. Sewage treatment is used to extract organic and inorganic particles; organic solids are broken down by microbes, and inorganic solids are sediment. It is especially important to protect human health from pathogenic species found in sewage before the treated effluent is released into receiving water bodies. Sewage must be treated before it may be dumped into rivers since they are such significant sources of drinking water. The two most prevalent types of wastewater are industrial and domestic wastewater. Sewage from restrooms and storm water runoff from cities make up domestic wastewater, which is produced by "non-manufacturing activities" in homes (such as cookhouses and restrooms).

The biological, chemical, and physical properties of water have an impact on its quality and also determine the state of water bodies. This could help in maintaining and improving the body of water to suit our demands for specific applications, such as public water supply, recreation, and agriculture. Aspects that are classified as biological include things like algal growth and biochemical needs, in addition to chemical and physical characteristics like temperature, turbidity, odor, and color. For treated wastewater used for irrigation, it is imperative to meet microbiological standards in addition to chemical and physical quality.

Maintaining a higher range of water quality is essential because a WWTP's primary objective is to reduce the amount of pollutants in wastewater, and the efficacy of this facility is always dependent on proper maintenance. There are multiple types of industrial wastewater based on the varied sectors and contaminants; each sector generates a unique combination of toxins. Physical, chemical, and biological pollutants that are commonly found in wastewaters have a serious negative influence on the ecosystem, endangering a multitude of biodiversities and wreaking irreversible ecological havoc.

The amount of oxygen required for aerobic bacteria to break down organic waste in water is known as the biological oxygen demand. Biological oxygen demand is a commonly used indicator of the degree of organic pollution in water in wastewater treatment facilities. Strict BOD level limitations apply to businesses that release wastewater into rivers or municipal sanitary sewers. The solids in waste water can be made up of organic and/or inorganic components and organisms; these must be significantly reduced during treatment to avoid a rise in BOD following discharge.

Chemical oxygen demand, or COD for short, is a measure of how much oxygen a body of water can absorb when breaking down organic compounds. COD analysis is used to measure pollutants (organics) in a water sample indirectly. It is an important component in assessing the water's

quality, reducing the danger to people and the environment. When evaluating the efficacy of water treatment facilities, COD is an excellent tool. If discharged water is not treated or is only partially treated, the effluent organics in it may compete with species downstream for oxygen. Assess the concentrations of oxidizable pollutants in wastewater, the effectiveness of various wastewater treatment methods, and the environmental effects of disposing of wastewater as a means of evaluating the general quality of the water.

TSS: Turbidity, or cloudiness, and total suspended solids (TSS) in water are often related. Environmental waters may contain a variety of dissolved or solid pollutants. When determining impurity levels, particles in the water column are referred to as suspended solids. TSS levels prevent sunlight from properly penetrating the water, which hinders the growth of plants and algae.

The treatment of wastewater occurs in three stages: Primary, secondary, and occasionally tertiary stages of treatment are used by the majority of municipal wastewater treatment plants. Colloidal and dissolved solids are eliminated from the main treatment's effluent by the secondary treatment technique.

Because biomass is used as an agent in the subsequent treatment of the wastewater, biological treatment is frequently referred to as secondary treatment. Soluble organic solids (BOD or COD) are reduced by microbial biosorption, which is followed by microbial degradation and stabilization. Colloidal suspensions are eliminated by the physiochemical adsorption principle and entanglement of suspended solids or particulate matter on the biological flock. It can be difficult to determine if developing a single treatment plant that processes a large amount of garbage or several plants that treat discrete small flows will result in a more efficient facility. Therefore, when considering a sewage treatment plant's capability, it is crucial to evaluate the environmental effects of the facility.

A biological treatment unit's efficiency depends on the growth of an appropriate simulated tile culture of microorganisms in the treatment unit (bioreactor), the maintenance of adequate environmental conditions for the system, and the removal of excess sludge produced. Wastewater that has excess organic sludge left in it will be evaluated as having higher BOD or COD in the final report.

Table 1. Details about the Lagoons of Vidyaranyapuram wastewater treatment plant

Lagoon	Length (m)	Width (m)	Depth (m)	Surface (m2)	Volume (m3)	Detention time (d)	Lagoon	Length (m)
Facultative Lagoon (2)	312	162	3.5	50,544	176,904	11.8	Facultative Lagoon (2)	312
Maturation pond (2)	172	145	1.5	24,940	37,410	2.5	Maturation pond (2)	172

Table 2. Result of wastewater quality parameters during 2018 from inlet and outlet point

S.No	Date	Influent			Effluent		
		BOD (mg/l)	COD (mg/l)	TSS (mg/l)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)
1	Jan-2018	275	216	117	13	63	31
2	Feb-2018	272	244	116	10	47	32
3	March-2018	272	153	144	9	21	30
4	April-2918	279	164	164	11	20	25
5	May-2018	279	155	161	11	29	35
6	June-2018	275	146	160	12	25	31
7	July 2018	270	158	167	12	40	34
8	Aug-2018	277	235	181	12	38	39
9	Sep-2018	279	173	173	12	31	47
10	Oct-2018	266	161	171	13	43	56
11	Nov-2918	276	178	174	13	48	57
12	Dec-2018	277	169	177	13	40	55

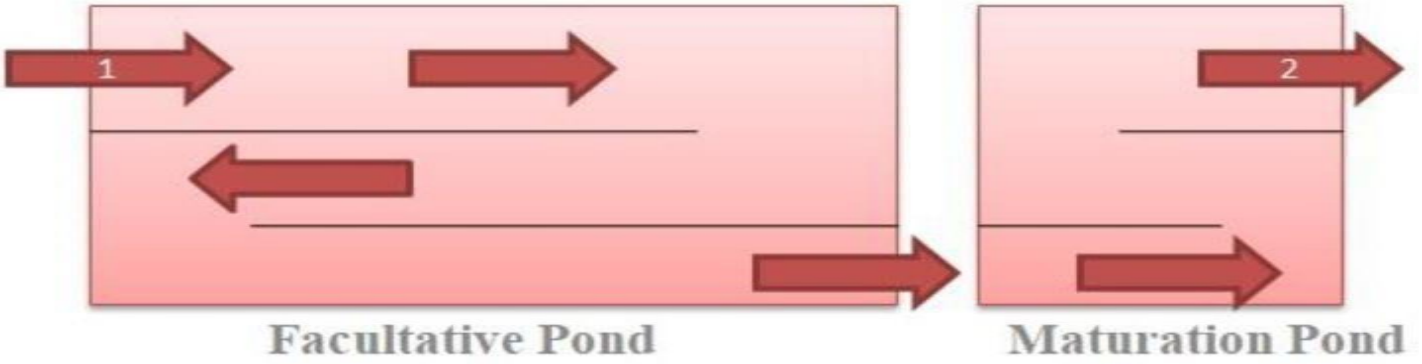
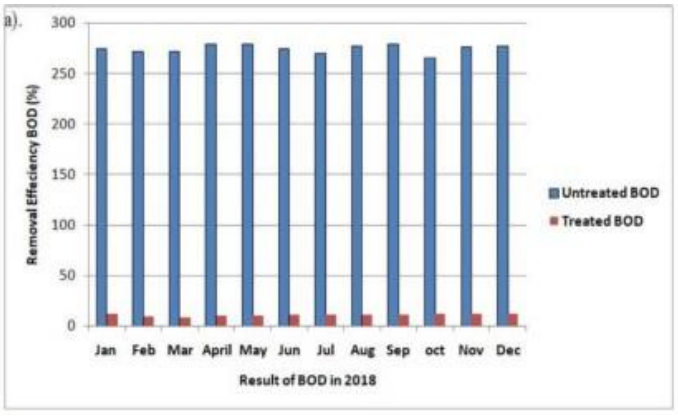


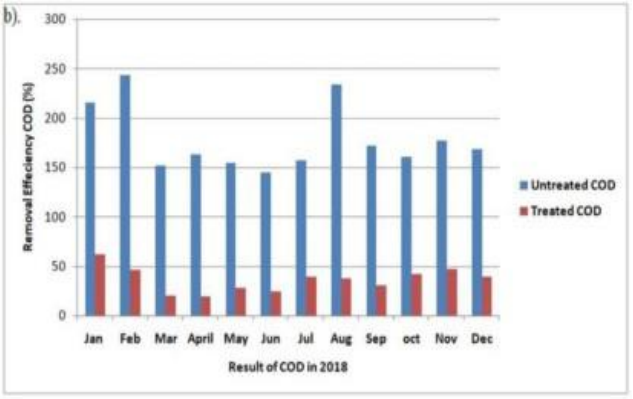
Fig. 1. Inflow and Outflow points at Vidyaranyapuram treatment plant, , Mysore Note: Sampling locations are marked - 1 (inlet point) to 2 (outletpoint)

Table 3. Percentage Elimination of Water Quality Parameter.

Serial No.	Water Quality Parameter (MLD)	Inflow in (MLD)	Outflow in (MLD)	% Removal
1	BOD (mg/l)	275	12	96
2	COD (mg/l)	179	37	79
3	TSS (mg/l)	158	39	75

Because of this, in order to assess the performance of the treatment plant, an assessment of the performance of the current treatment plant is necessary, together with an assessment of the treatment plant's capacity to handle bigger hydraulic and organic loadings, either to satisfy higher treatment requirements or to enhance the quality of the present effluent. It is advantageous to evaluate the performance of current treatment plant systems because it generates new data that can be used to enhance the design processes for these units.





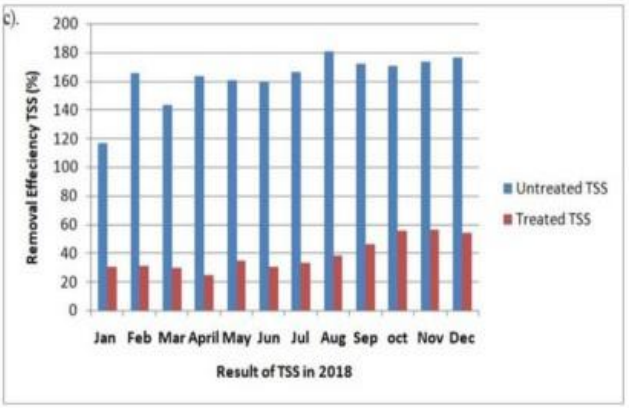


Fig. 2. Depicts the concentrations of various pollutants collected from the study area during the period. a)Removal Efflciency BOD, b) Removal Efflciency COD, c)Removal Efflciency TSS

2. CASE STUDY

2.1 Data and methodology

Located in Karnataka, Mysuru is 700 meters above sea level and is between 12 ◦ 90e11 ◦ 60 N and 77 ◦ 70e76 ◦ 40 E. The population of the royal district increased from 0.795 million in 2001 to 0.983 million in 2011. The monsoon season, which lasts from late May until the end of October, brings with it temperature fluctuations of 14 to 34 °C. Among the most well-known lakes in the city are Kukkarahalli, Karanji, and Lingambudhi.

The Cauvery and Kabini rivers, along with certain groundwater sources, supply the majority of the city's residential water requirements. Three basins receive the waste water released from Mysore city due to gravity. The northern drainage system in Kesare Village, Mysore, feeds into a 30.0 MLD STP (mechanical system with aerators). The southwestern drainage flow links to the 67.65 MLD Vidyaranyapuram STP (Biological treatment that uses required microorganisms (OS-1&2) inoculum) before it approaches Dalvai Kere. The 60 MLD Rayankere STP (remedia-tion based on Fermenta's bacillus) is located at H. D. Kote Road, to the south. The Vidyaranyapura STP, situated near a solid-waste disposal site on the foothills of the Chamundi Hills in the downstream slope of the tributary to Dalvai Lake, between 12.273681 ◦ N and 12.270031 ◦ E, is where the field surveys were conducted. The treatment plants consist of two maturation ponds (each measuring 2.5 ha in area and 1.5 m in depth) and two facultative lagoons (each with a surface area of 5.05 ha and a depth of 3.5 m). Table 1 is a list of the details. Before arriving at the Kabini River, a source of potable water, the cleaned water flows via the Dalvai kere for almost 20 kilometers. To make sure that Kabini water is not contaminated, this necessitates an evaluation of the treated effluent from the STP

This study's main objective is to investigate and assess the Vidyaranyapuram treatment plant's output in Mysore. Throughout the course of a year (2018), regular monitoring sample campaigns were conducted with a primary focus on three parameters: BOD, COD, and TSS (Table 2). Two locations for sampling were identified: the effluent from the wastewater treatment plant and the secondary treatment process outflow. A thorough examination of the Vidyaranyapuram WWTP lab study's average concentrations of COD, BOD, and TSS in comparison to their theoretical relationships demonstrates a high degree of reliability. Based on the outcomes, we may determine the removal efficiency of the various parameters for every step of the wastewater treatment facility.

3. RESULT AND DISCUSSION

The wastewaters had a mean pH of 7.7 and ranged from 7.4 to 8. pH was computed and imported since it is a highly effective parameter in calculating the removal efficiencies of different contaminants. The concentrations of several contaminants that were gathered from the two designated sample stations throughout the study area are shown in Fig. 1. Three metrics for measuring the quality of wastewater—BOD, COD, and TSS—were collected and examined from samples that lasted a year. The % elimination for each of these factors has been calculated and is displayed in Table 3 and Fig. 2.

Table 3 demonstrates that under the aforementioned circumstances, the plant's BOD removal effectiveness is approximately 96%, although the removal efficacy of COD and TSS is less than that of BOD, at approximately 79% and 75%, respectively.

4. CONCLUSION

The results of the current studies on the treatment efficacies of the STP showed that the removal of BOD (96%) was treated at a good level, and the removal of COD (79%) and TSS (75%) was treated with reasonable quality. Chemical and biological techniques were employed to determine the removal efficacies of treatment plants. Our results show that the effluent water's BOD level is higher than its COD and TSS values. BOD could be more than COD and TSS if the sample had highly degradable organic matter, larger concentrations of organic nitrogen or ammonium in the water, or organic nitrogen that could be physiologically oxidizable but not oxidized by chromic acid in the COD technique.

In order to improve STP efficiency, sources of raw sewage must be identified, treatment technologies must be effectively managed and maintained, and existing facilities must be updated accordingly. At predetermined intervals, skilled and knowledgeable personnel must assess treatment performance to guarantee proper operation and maintenance. To the greatest extent possible, STPs should be utilized to control the quality of the final product, and the sources of raw sewage should be identified.

There are no conflicts of interest

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