IJHAS
International Journal of Health and Allied Sciences
Official Publication of JSS Academy of Higher Education and Research (JSS AHER), Mysuru

Manuscript 1023

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CASE REPORT

Performance Evaluation of Wastewater Treatment Plant, Vidyaranyapuram, Mysuru

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Abstract

Background: **The primary goal of sewage water treatment is to eliminate or bring down the number of pollutants in the sewage water. This study was needed to assess the efficacy of a sewage treatment plant in reducing contaminants levels to comply with government environmental standards. The wastewater re-use for irrigation approaches must be in compliance with the guidelines and indicators must be tracked and impended consistently, it is therefore essential to give top priority to requirements at the stage of evaluating and development to protect land and water supplies as well as public health.**

Methods: **Chemical and biological approaches were used to regulate the removal efficiency of treatment plants. The performance and effectualness of the Vidyaranyapuram sewage treatment plant (STP) in Mysore are evaluated and analyzed in this report.**

Novelty: **Water quality needs to be regularly checked in wastewater treatment facilities. The current study will aid the treatment facility in its efforts to enhance the process of treatment. One would be able to update the effluent efficiency levels depending on the seasonal variations in wastewater treatment as the assessment explains the number of water quality metrics in waste water plants. The obtained analysis results are very helpful in locating, fixing, and maintaining plant operating and maintenance issues, which may be helpful for next plant expansion to be carried out to get good results.**

Result: **The STP's treatment efficiencies were discovered to have a good treatment level in BOD (96%) and a moderate treatment quality in COD (79%) and TSS (75%) removal efficiency during the year 2018.**

Conclusion: **To ensure correct operation and maintenance, trained and experienced workers must analyze treatment performance at predetermined time intervals. The result explains the quality of effluent water and performance of treatment plant. STPs should be used to their full potential to manage the quality of final effluent, and raw sewage sources should be identified.**

Keywords: Wastewater treatment, Efficiency, Mysore, Performance, Evaluation, Sewage treatment plant

1. Introduction

Sewage treatment plants are now facing new problems to meet stricter wastewater disposal limits. The freshwater shortage is no longer a problem limited to Mysuru, but has evolved into a global issue that has emerged in the twenty-first century. It will be a witness to the emergence of a global water crisis [1]. Sewage treatment's overall water conservation goals include the elimination of

Received 31 March 2022; revised 13 November 2022; accepted 13 November 2022.
Available online 29 March 2023

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https://doi.org/10.55691/2278-344X.1023

toxins as well as the protection and preservation of our natural water supplies. The protection of human health from pathogenic species found in sewage before the discharge of the treated effluent into receiving water bodies is of particular concern and Sewage treatment is used to extract organic and inorganic particles, with organic solids being degraded by microbes and inorganic solids being sediment. Since rivers are such important sources of drinking water, sewage treatment is needed before it can be discharged into them [2,8,11].

Domestic wastewater and industrial wastewater are the two most common types of wastewater. Domestic wastewater is made up of sewage from lavatories and storm water runoff from cities, which is provided by "non-manufacturing activities" in residences (from washrooms and cookhouses) [3,9,12].

Water quality is affected by its biological, chemical, and physical characteristics, which also define how water bodies are doing. This could assist in managing and upgrading the water body to meet our needs for certain uses like agriculture, recreation, or public water supply. Biological attributes include things like biochemical demand and algae growth, as well as chemical and physical characteristics like turbidity, temperature, odour, and colour. It is crucial to maintain microbiological criteria in addition to chemical and physical quality for treated effluent water used for irrigation. It is imperative to maintain better water quality range because the major goal of a WWTP is to minimize toxins from wastewater, and this facility's effectiveness always depends on the good maintenance. Based on the various sectors and contaminants, there are several different forms of industrial wastewater; every sector produces a distinct mix of contaminants. Wastewaters are frequently polluted with physical, chemical, and biological components that have a substantial detrimental impact on the ecosystem, posing a threat to many biodiversities and causing irreparable ecological devastation [4,10].

Biological oxygen demand is a measurement of the quantity of oxygen needed for aerobic bacteria to decompose waste organic matter in water. In wastewater treatment facilities, biological oxygen demand is frequently employed as a gauge of the level of organic pollution in the water. Strict limitations on BOD levels apply to industries that discharge wastewater into municipal sanitary sewers or rivers. Organic and/or inorganic elements and organisms can make up the solids in wastewater, which must be greatly decreased during treatment in order to prevent a rise in BOD after discharge [5].

COD is the capacity of water to consume oxygen during the breakdown of organic materials in the water is measured by the term chemical oxygen demand. Indirect measurement of contaminants (organics) in a water sample is done using COD analysis. It is a crucial factor in determining the quality of water, lowering the risk to both humans and the environment. COD is a great tool for assessing the effectiveness of water treatment facilities. Discharged water contains effluent organics that can compete with downstream species for oxygen if water is left untreated or only partially treated. As a gauge for overall water quality, determine the amounts of oxidisable contaminants in wastewater, evaluate the efficacy of wastewater treatment options, and determine the environmental impact of wastewater disposal [6].

TSS: Total suspended solids (TSS) and turbidity (cloudiness) of water are frequently connected. Various solid or dissolved contaminants may be present in environmental waters. Particles in the water column are referred to as suspended solids when calculating impurity levels. TSS levels make it harder for plants and algae to develop because sunlight cannot effectively permeate the water [7].

There are three different stages of wastewater treatment: The majority of municipal wastewater treatment facilities use primary, secondary, and some tertiary levels of treatment. The secondary treatment method removes colloidal and dissolved solids from the effluent generated by the primary treatment. The wastewater is then treated with biomass as an agent, which is why biological treatment is often referred to as secondary treatment [8].

Colloidal suspensions are removed using the physiochemical adsorption principle and entanglement of suspended solids or particulate matter on the biological flock, while soluble organic solids (BOD or COD) are reduced using microbial biosorption and subsequent degradation and stabilization by microbes [9]. It's tough to predict whether a single treatment plant that handles a huge volume of waste is efficient or multiple plants that treat individual small flows are more effective when designing a plant. As a result, it is important to assess the environmental consequences of a sewage treatment plant when taking into account its capability. The development of a suitable mock tile culture of microorganisms in the treatment unit (bioreactor), maintaining sufficient environmental conditions for the system, and removing excess sludge generated are all essential for a biological treatment unit's efficiency. If excess sludge, which is organic, is not removed from wastewater, it will be assessed as increased BOD or COD in the final

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

Lagoon	Length (m)	Width (m)	Depth (m)	Surface (m^2)	Volume (m^3)	Detention time (d)
Facultative Lagoon (2)	312	162	3.5	50,544	176,904	11.8
Maturation pond (2)	172	145	1.5	24,940	37,410	2.5
						14.3

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

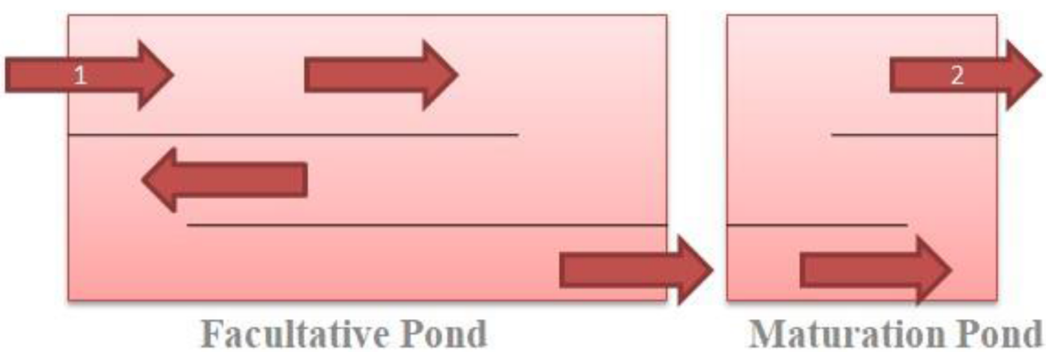

Fig. 1. Inflow and Outflow points at Vidyaranyapuram treatment plant, Mysore Note: Sampling locations are marked - 1 (inlet point) to 2 (outlet point).

Table 3. Percentage elimination of water quality parameter.

Serial No	Water quality parameter	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

effluent, which will eventually deplete the dissolved oxygen DO of the receiving stream when disposed into a stream [9,13].

As a result, to evaluate the treatment plant's performance, a performance evaluation of the existing treatment plant is required, as well as determining if the treatment plant can handle larger hydraulic and organic loadings, in order to improve current effluent quality and/or meet greater treatment requirements. The practice of assessing the performance of existing treatment plant systems is beneficial in terms of creating new data that can be utilized to improve the design procedures for these units [14,15].

2. Case study

2.1. Data and methodology

Mysuru, which is 700 m above sea level, is located in Karnataka between 12°9′–11°6′ N and 77°7′–76°4′ E. The region is a royal district with a headcount of

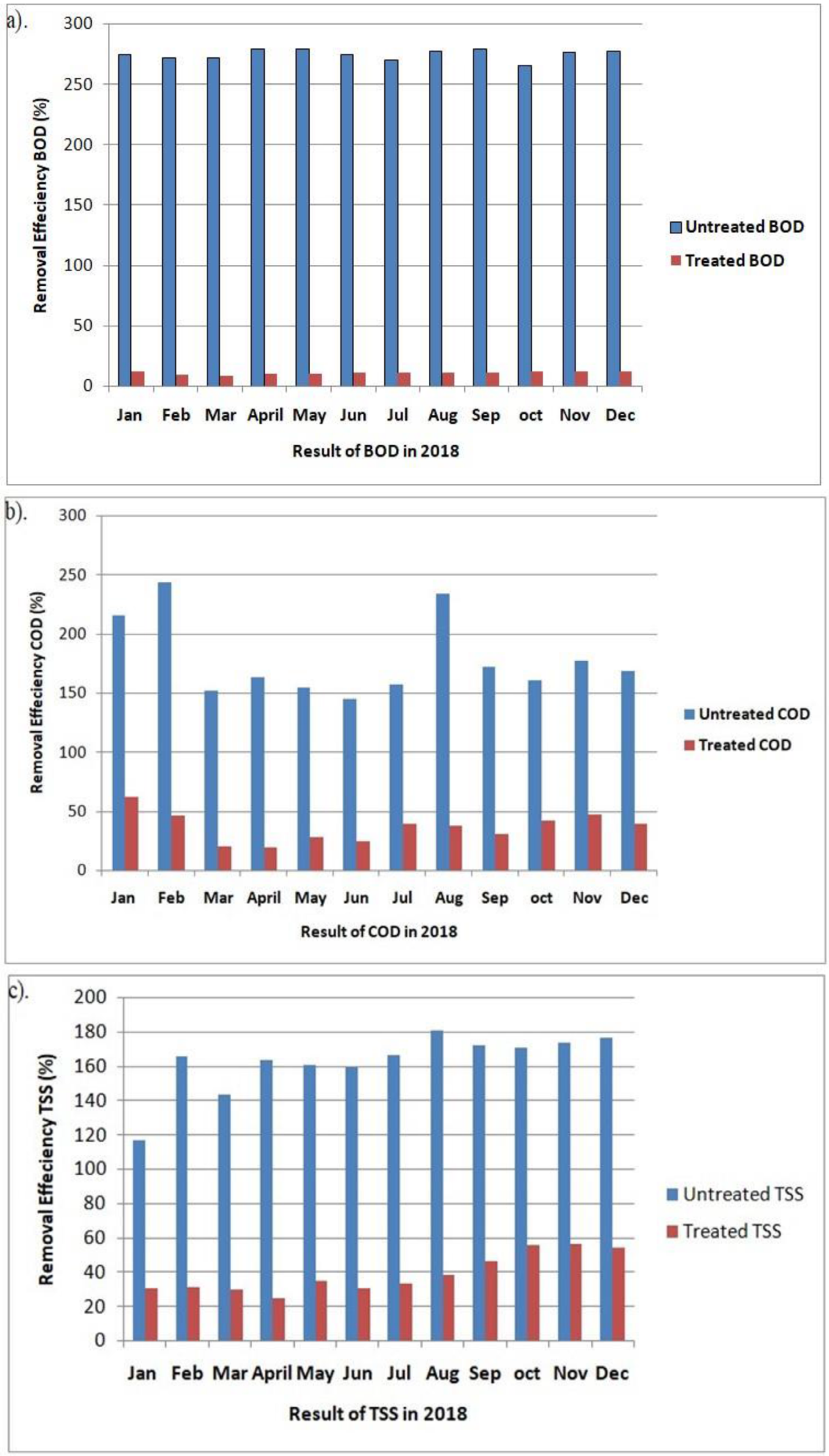

Fig. 2. Depicts the concentrations of various pollutants collected from the study area during the period, a) Removal Efficiency BOD b) Removal Efficiency COD c) Removal Efficiency TSS.

0.983 million people in 2011, up from 0.795 million in 2001. The temperature fluctuates from 14 to 34 °C, and monsoon rainfall begins in late May and lasts until the end of October. Kukkarahalli, Karanji, and Lingambudhi are three of the city's most prominent lakes. The city's domestic water needs are fulfilled primarily by the Cauvery and Kabini rivers, as well as some groundwater sources. By gravity, the waste water discharged in Mysore city makes its way into three basins. At Kesare Village in Mysore, the northern drainage system feeds to a 30.0 MLD STP (mechanical system with aerators). Before approaching Dalvai kere, the southwestern drainage flow links to the 67.65 MLD Vidyaranyapuram STP (Biological treatment that uses necessary microorganisms (OS-1&2) inoculum). At H. D. Kote Road, to the south, is the 60 MLD Rayankere STP (remediation based on Fermenta's bacillus). The field surveys were performed at Vidyaranyapura STP, which is located between 12.273681° N and 12.270031° E, near to a solid-waste disposal site at the foothills of the Chamundi Hills in the downstream slope of the tributary to Dalvai lake. The treatment plants are made up of two facultative lagoons (each with a surface size of 5.05 ha and a depth of 3.5 m) and two maturation ponds (each of 2.5 ha of area and 1.5 m depth). The details are listed in Table 1. The cleaned water travels about 20 km along the Dalvai kere before reaching the Kabini River, which is a source of drinking water. This demands a review of the STP's treated effluent to ensure that Kabini water is not contaminated.

The primary goal of this research is to examine and evaluate the output of Mysore's Vidyaranyapuram treatment plant. The sampling campaigns were regular monitoring carried out over a year (2018) focused on the study of mainly three parametersBOD, COD, and TSS (Table 2). There were two sampling points found: (1) the wastewater treatment plant influent; and (2) the secondary treatment process outlet. A comparison of the average concentration of COD, BOD, and TSS with the theoretical relationship between these parameters reveals a high level of reliability in the Vidyaranyapuram WWTP lab study. We may calculate the removal efficiencies of the various parameters for each stage of the wastewater treatment plant based on the results.

3. Result and discussion

The pH levels of the wastewaters ranged from 7.4 to 8, with a mean of 7.7. Since pH is a very successful parameter in determining the removal efficiencies of various pollutants, it was calculated and imported. Fig. 1 depicts the concentrations of various pollutants collected from the two allocated sampling points over the course of the study area. BOD, COD, and TSS are three wastewater quality metrics that were obtained and analyzed from one-year samples. For each of these parameters, the percentage elimination has been determined and is shown in Table 3 and Fig. 2.

Table 3 shows that in the above conditions, the removal efficiency of BOD in the plant is about 96% while the removal efficiency of COD and TSS is about 79% and 75% respectively, which is lower when compared to BOD.

4. Conclusion

The current investigations into the STP's treatment efficiencies revealed a good treatment level in BOD (96%) and a reasonable treatment quality in COD (79%) and TSS (75%) removal efficiency. The removal efficiencies of treatment plants were determined using chemical and biological methods. Our findings demonstrate that the BOD level in the effluent water is higher than the COD and TSS levels. When the sample contains highly degradable organic matter, higher levels of organic nitrogen or ammonium in the water, or organic nitrogen that may be physiologically oxidizable but not oxidized by chromic acid in the COD technique, BOD may be higher than COD and TSS. To increase STP efficiency, treatment technologies must be successfully managed and maintained, raw sewage sources must be recognized, and current facilities must be updated correspondingly. To ensure correct operation and maintenance, trained and experienced workers must analyze treatment performance at predetermined time intervals. STPs should be used to their full potential to manage the quality of final effluent, and raw sewage sources should be identified.

Conflict of interest

There are no conflicts of interest.

Acknowledgement

I Would like to acknowledge City Municipal Office, Mysore, For providing Secondary data to my research work.

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