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Waste water Quality for Sewage treatment plant

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Abstract: This paper presents a designed sewage treatment plant (STP) for Alard College of Engineering and Management, located in Marunje, Pune. This initiative is part of a broader strategy to enhance the college's environmental stewardship and sustainability practices. The proposed STP is specially tailored to reduce the generation of wastewater, convert waste into useful manure, and recycle treated water for horticultural purposes, aligning with the college's green initiatives. The necessity for such a system is underscored by the significant number of users on campus—currently 6,820—with projections indicating an increase in both population and infrastructural capacity. Currently, the campus maintains a total water storage capacity of 82,000 liters, which is anticipated to expand by an additional 30,000 liters in the near future. This expansion, coupled with increasing daily water usage, accentuates the critical need for effective water management solutions that ensure sustainability and minimize environmental impact .Extensive testing of the STP design has been conducted to ensure it meets the specific needs of the college. These tests take into account not only the current and projected usage patterns but also the potential impacts of climate change, ensuring the system's resilience and adaptability. Results from these tests have been meticulously recorded and analyzed, with graphical representations used to illustrate how the STP will perform under different environmental conditions. This holistic approach to wastewater management does not solely focus on technical and functional aspects; it also emphasizes the college's dedication to embedding sustainability and innovation within its operational practices. By integrating the STP into the campus infrastructure, Alard College not only aims to significantly reduce its environmental footprint but also sets a benchmark for other institutions in terms of sustainable campus management and responsible water use. This initiative exemplifies how environmental challenges can be turned into opportunities for innovation and leadership in sustainability.

Index Terms **– Sewage treatment plant, pH, COD, BOD,TSS, TDS, Seasons , plants , KLD.**

I. INTRODUCTION

This paper proposes establishing a wastewater treatment plant at Alard College of Engineering and Management in Marunje- The proposal to establish a wastewater treatment plant at Alard College of Engineering and Management in Marunje-Pune marks a significant stride towards addressing the pressing issues of water scarcity and environmental degradation within the campus community. With the institution's expansive campus and diverse array of structures, water consumption and wastewater generation have reached considerable levels, necessitating urgent action for sustainable management. This paper presents a meticulously crafted analysis and interdisciplinary approach aimed at conceptualizing and executing a wastewater management system tailored precisely to the unique needs and challenges faced by Alard College.. By harnessing the power of strategic planning, collaborative efforts, and innovative solutions, the establishment of a wastewater treatment plant at Alard College signifies a proactive response to the mounting water management needs and environmental responsibilities of the institution, thereby setting the stage for a more sustainable and resilient future.[1]

The sprawling expanse of Alard College's campus, spanning an impressive 10.86 acres, hosts a myriad of structures catering to diverse functions and populations. The sheer scale of the campus operations has led to a substantial future wastewater generation, estimated at a staggering 250 kiloliters per day (KLD). With a current population of 6,200 individuals projected to surge to approximately 6,820 over a 30-year design period, the demand for water resources is poised to escalate significantly in the foreseeable future. This burgeoning demand is met with a complex web of infrastructure, including but not limited to, girls' and boys' hostels, engineering, MBA, and MCA colleges, a junior college, a school building, and a pharmacy building, each equipped with varying water storage capacities and consumption rates. For instance, the girls' hostel, accommodating 400 individuals, boasts a water storage capacity of 9,000 liters, while the boys' hostel, with 550 residents, has a storage capacity of 15,000 liters. Similarly, the engineering college, housing 1,650 individuals, is outfitted with an 8,000-liter water storage capacity, whereas the MBA and MCA colleges, accommodating 1,150 persons, utilize a 10,000-liter storage. Furthermore, the junior college, school building, and pharmacy building each contribute to the water usage and management considerations within the complex, with their respective storage capacities and consumption rates. Given this intricate interplay between water consumption and infrastructure dynamics, the imperative to establish

a wastewater treatment plant at Alard College becomes glaringly evident, transcending from a mere necessity to an unavoidable inevitability.[3]

II. METHODOLOGY

The extended Aerated sewage treatment plant (STP) implemented for Alard College exhibits varying performance across different seasons, as indicated by the following parameters:

The During the monsoon season, the temperature averages 25.3°C, with a slightly elevated pH level of 9. Dissolved oxygen (DO) concentration is at 8.65 mg/l, indicating relatively low oxygen levels. The biochemical oxygen demand (BOD) at day 5 ranges between 80 mg/l, suggesting high organic pollution levels. Additionally, the chemical oxygen demand (COD) stands at 80 mg/l, while total suspended solids (TSS) and total dissolved solids (TDS) are at their highest levels of 21 mg/l and 919 mg/l, respectively.[9]

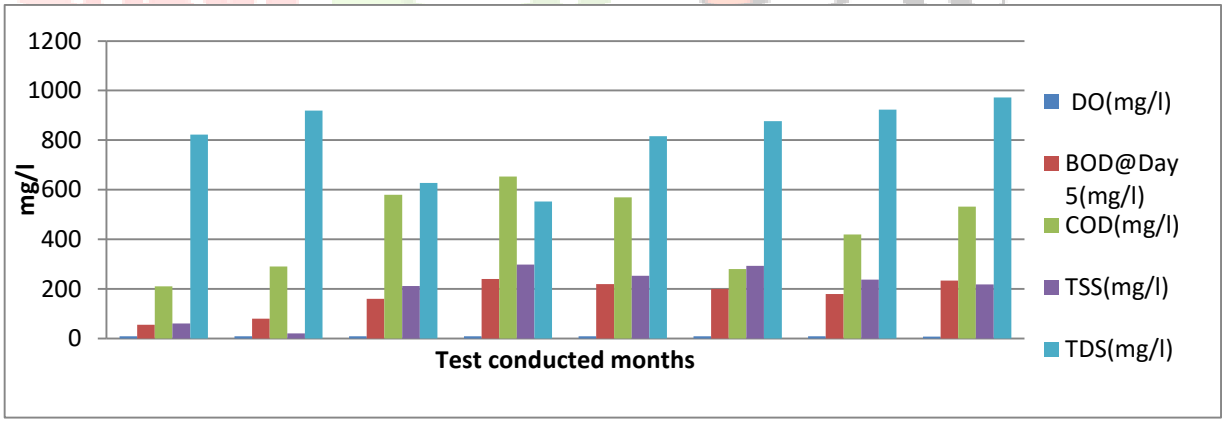
In contrast, the winter season witnesses a decrease in temperature to 22.5°C, with a pH of 8.5. Despite the cooler temperatures, DO levels increase to 0.89 mg/l, potentially facilitating better aerobic degradation of organic matter. BOD at day 5 and COD show slight increases by 160 and 362.74 compared to the monsoon season, while TSS and TDS exhibit a modest increase by 277 .

During the summer season, the temperature rises significantly to 29°C, with a pH of 8. DO levels goes down to 7.67 , indicating potential challenges in maintaining adequate oxygenation. BOD at day 5 decreases by a little , suggesting heightened organic pollution. COD, TSS, and TDS exhibit further increases compared to the winter season, highlighting the potential strain on the treatment system during warmer months.[2]

Overall, these variations in performance across different seasons underscore the importance of adaptive management strategies and seasonal adjustments in optimizing the extended sewage treatment plant's efficiency and effectiveness for Alard College.

Month -Year	DO(mg/l)	BOD@Day 5(mg/l)	COD(mg/l)	TSS(mg/l)	TDS(mg/l)
Aug-23	8.56	55	210.53	61	822
Sep-23	8.48	80	290.32	21	919
Oct-23	8.72	160	580	212	628
Nov-23	9.07	240	653.06	298	553
Dec-23	9.26	220	569.11	253	816
Jan-24	9.45	200	280	293	876
Feb-24	8.9	180	420	237	923
Mar-24	7.67	234	532	218	972

This is the graph based on the seasonal change in characteristics of Sewage treatment



III. APPLICATION

The Sewage Treatment Plant (STP) at Alard College of Engineering and Management plays a crucial role in managing wastewater from the college's facilities, ensuring the removal of contaminants and protecting public health and local water bodies. This STP not only helps the college comply with environmental regulations but also enables the reuse of treated water for various sustainable applications. These practices not only conserve freshwater resources but also enhance the green spaces and biodiversity on the college campus.[5]

- The water can be also used for construction (curing) purpose
- Water can be stored in fire tank to be used in emergency purpose
- Plants like Sunflower, bamboo, canola, mustard can sustain only on treated water contributes to sustainable agriculture practices by reducing the need for chemical fertilizers
- The water can be sprinkled on roads for dust control, cooling the heat of roads, to moisturize the soil, etc.
- The water can also be for increasing ground water table.

- The dried sludge can also be used as fertilizers
- The STP at Alard College also supports environmental education by serving as a living laboratory for students studying sustainable water management, agriculture, and environmental science.
- Additionally, in water-stressed areas, using treated water for agricultural purposes such as irrigation helps reduce the strain on natural water sources

IV. CONCLUSION

In conclusion, the extended sewage treatment plant at Alard College demonstrates varying performance across seasons, as evidenced by the test results. These results underscore the need for adaptive management strategies to optimize plant performance year-round and ensure regulatory compliance. The proposal to establish a wastewater treatment plant at Alard College of Engineering and Management in Marunje-Pune represents a proactive step towards addressing water scarcity and environmental concerns within the campus community. With a comprehensive analysis of current water consumption patterns and infrastructure requirements, the proposed plant aims to mitigate wastage, reduce pollution, and promote water conservation through tailored solutions. The results show that Do peak was 9.45 mg/l at January 2024, BOD peak was 240 mg/l on November 2023 @ Day 5, COD peak was 653.06mg/l on November 2023, TSS peak was 298 mg/l on November 2023 and TDS peak was at 923 mg/l on February 2024 Moreover, the implementation of an extended sewage treatment plant underscores the college's commitment to environmental stewardship andpeak test result should be considered while designing the STP. By leveraging treated water for diverse applications including irrigation for green spaces and specialized agricultural projects, Alard College demonstrates a holistic approach to sustainability that enriches both the campus environment and the educational experience of its students. Furthermore, through workshops, seminars, and hands-on projects, the college cultivates a culture of innovation and prepares future leaders to address pressing environmental challenges, ensuring a sustainable future for generations to come.

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