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Natural Filtration to Improve the Quality Product from Domestic Wastewater Treatment Plant Using *Heliconia psittacorum* and Napier Grass (*Pennisetum purpureum*)

Aurum Azzahra[1*], Badrus Zaman[1], Heru Susanto[1]

[1] Master of Environmental Engineering Program, Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia.

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Corresponding Author:
Aurum Azzahra
aurumazzahra@gmail.com

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Abstract: As a developing wastewater treatment system, constructed wetlands have increasingly been implemented in several regions due to their high purification efficiency and relatively low operational costs. This study aims to improve the quality of treated water from domestic Wastewater Treatment Plants (WWTP) through natural filtration methods based on sandy soil media that contain 70% soil and 30% sand and planted with *Heliconia psittacorum* and Napier grass (*Pennisetum purpureum*). The natural filtration such as constructed wetland were applied in open tanks, with varying retention times 2, 4, 6, 8 and 10 days to test treatment effectiveness, the wastewater quality was analyzed based on parameters including COD, BOD, TSS, ammonia, phosphate, nitrate, and pH. The results showed a significant reduction in pollutant concentrations, with the highest removal efficiency reaching for BOD 86.41%, COD at 86.54%, nitrate at 98.92%, phosphate at 97.86%, at 99.84% and TSS at 86.39% resulting in treated water that meets the domestic wastewater quality standards according to Government Regulation No. 22 of 2021 for class 3., enhancing nutrient uptake and supporting microbial activity within the filtration media. This method offers a cost-effective, environmentally friendly alternative for domestic wastewater treatment, suitable for application in areas with limited land availability and aiming for sustainable water management.

Keywords: Class 3 water quality; Domestic wastewater; Natural filtration

Introduction

The Effective treatment and management of domestic wastewater generated from sources such as showers, sinks, and laundry play a crucial role in addressing water scarcity and minimizing environmental pollution. Without proper management, domestic wastewater can degrade the quality of rivers, groundwater, and other water sources, ultimately impacting public health (Levi, 2009).

According to the Technical Approval and Operational Feasibility Letter regulations No. 5 of 2021 of the Indonesian Ministry of Environment and Forestry (Kementrian Lingkungan Hidup, 2021), every activity that generates wastewater during its operations is required to have a wastewater treatment plant (IPAL) (Vries et al., 2025). Improperly managed domestic wastewater can significantly degrade rivers, groundwater, and other water bodies, posing serious threats to public health and ecosystem integrity. In Indonesia, regulatory frameworks such as the technical standards for effluent quality that must be met, especially if the treated water is to be reused for groundwater recharge or discharged into the environment. Based on Appendix VI of Government Regulation No. 22 of 2021 on Environmental Protection

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and Management, there are four classes of water quality. Wastewater intended for groundwater recharge must meet at least Class 3 standards. Therefore, domestic wastewater must be properly treated and, if possible, reused to reduce environmental pollution (Sulianto et al., 2019).

Constructed wetland technology it is widely accepted for managing various types of contaminated water including industrial effluent. Currently, several methods are available to improve industrial wastewater quality (Krishnaswamy, 2025). However, most are required significant capital investment, operational costs, and maintenance. One promising alternative is the constructed wetland (CW) method—an engineered natural wetland for wastewater treatment (Chen et al., 2023). Constructed wetlands have been shown to effectively reduce or remove pollutants from wastewater (Ameso et al., 2023). Various wetland technologies have been explored as cost-effective and sustainable alternatives for domestic wastewater treatment due to their potential for continuous pollutant removal (Pérez et al., 2023). this technology can be utilized as a green area, for irrigating plants and can be an effective sustainable and circular solution for wastewater treatment and reuse even in the most difficult environmental conditions (Chen et al., 2023) and at the largest scale (Ishtiaq et al., 2025).

Heliconia psittacorum and Napier grass were used as a variety of constructed wetland plants. Heliconia is a flowering plant that widely grown as a landscaping plant because of their attractiveness. Heliconia has been quite effective in reducing pollutant load in the form of BOD, Nitrate and Phosphate on domestic wastewater (Baharuddin et al., 2021). Several studies have shown that Napier grass has an efficient ability to absorb pollutants from wastewater due its rapid growth (Miranda, 2020), including organic materials and nutrients such as nitrogen and phosphorus. In wetlands, Napier grass roots play an important role in absorbing nutrients from wastewater and converting them into organic matter, thus producing cleaner water. Napier grass has significant effectiveness in removing N and P from domestic wastewater (Klomjek, 2016).

This research is important for several reasons such as by developing a system that meets Indonesia's regulatory standards for water quality, the research supports legal compliance and helps protect public health, The integration of ornamental and fast-growing plants enhances urban green spaces, supports biodiversity, and provides opportunities for water reuse in irrigation. In this study, we aim to conduct a comparative analysis of pollutant removal efficiency so that the system can be utilized as a green area and for irrigating plants. The treatment is conducted physically, using a natural filtration system based on the constructed wetland method, in which domestic wastewater flows through a wetland area consisting of sandy soil so that pollutants are absorbed by the sandy soil media.

Method

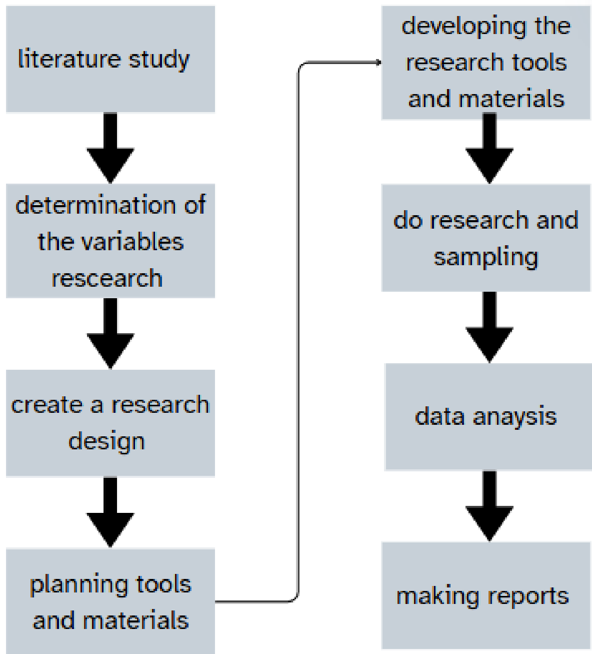

Figure 1. Research diagram flow

Tools and Materials

The tools used were calorimeter, beaker glass, scale, measuring glass, block board 18x3 m, Steel anger 40x40, Plastics sheets gutters red black carpet, drum 200 L, PVC Pipe 2 inch, clear tubing and pH meter and calorimeter. The materials used were NPK fertilizer 8.69%, tap water, sucrose, fine sand, gravel, soil, 20 pcs of mature *Heliconia psittacorum* and 10 pcs of mature *Pennisetum purpureum*.

Wetland Construction

At this stage, the construction will be made into a wetland where the planting medium uses sandy soil and is planted with plants.

Preparation of Artificial Domestic Wastewater

In this process, artificial domestic wastewater is made using NPK fertilizer and sugar so that the artificial domestic wastewater is more stable and the results are more concentrated, where the calculation for making artificial wastewater is as follows:

Calculation of Artificial Solution

Determination of NPK weight to achieve ammonia in the range of 100 ppm.

$$\text{NPK needs} = \frac{\frac{\text{Conscnt} \times \text{Vol drum}}{1000}}{\text{Purity}}$$

$$\text{NPK needs} = \frac{\frac{15\frac{\text{mg}}{\text{l}} \times 200\ \text{lt}}{1000}}{8.69\%} = 34.52\ \text{ml}$$

The N content in NPK is 8.69%

$$\text{Sugar needs} = \frac{\frac{\text{Conscnt} \times \text{Vol drum}}{1000}}{\text{Purity}}$$

$$\text{Sugar needs} = \frac{\frac{60\ \text{mg/l} \times 200\text{lt}}{1000}}{75\%} = 16\ \text{gr}$$

The Process of Upgrading Artificial Wastewater with a Natural Filtration Process

The third stage is the process of improving artificial water wastewater with a natural filtration process using sandy soil media using ornamental *Heliconia psittacorum* and *Pennisetum purpureum* with research variables that will be conducted on filtration retention time. In the initial planning, variations of residence time will be used for 2, 4, 6, 8, and 10 days.

Data Analysis

The response of water quality parameters is to the values of pH, COD, BOD, TSS, NO_3, PO_4, NH_3 and TSS. The BOD value is determined from the 1x COD and BOD measurement ratio for each inlet and outlet, so that the BOD/COD ratio value is obtained for the inlet and outlet.

With the design of the research as in the Figure 2.

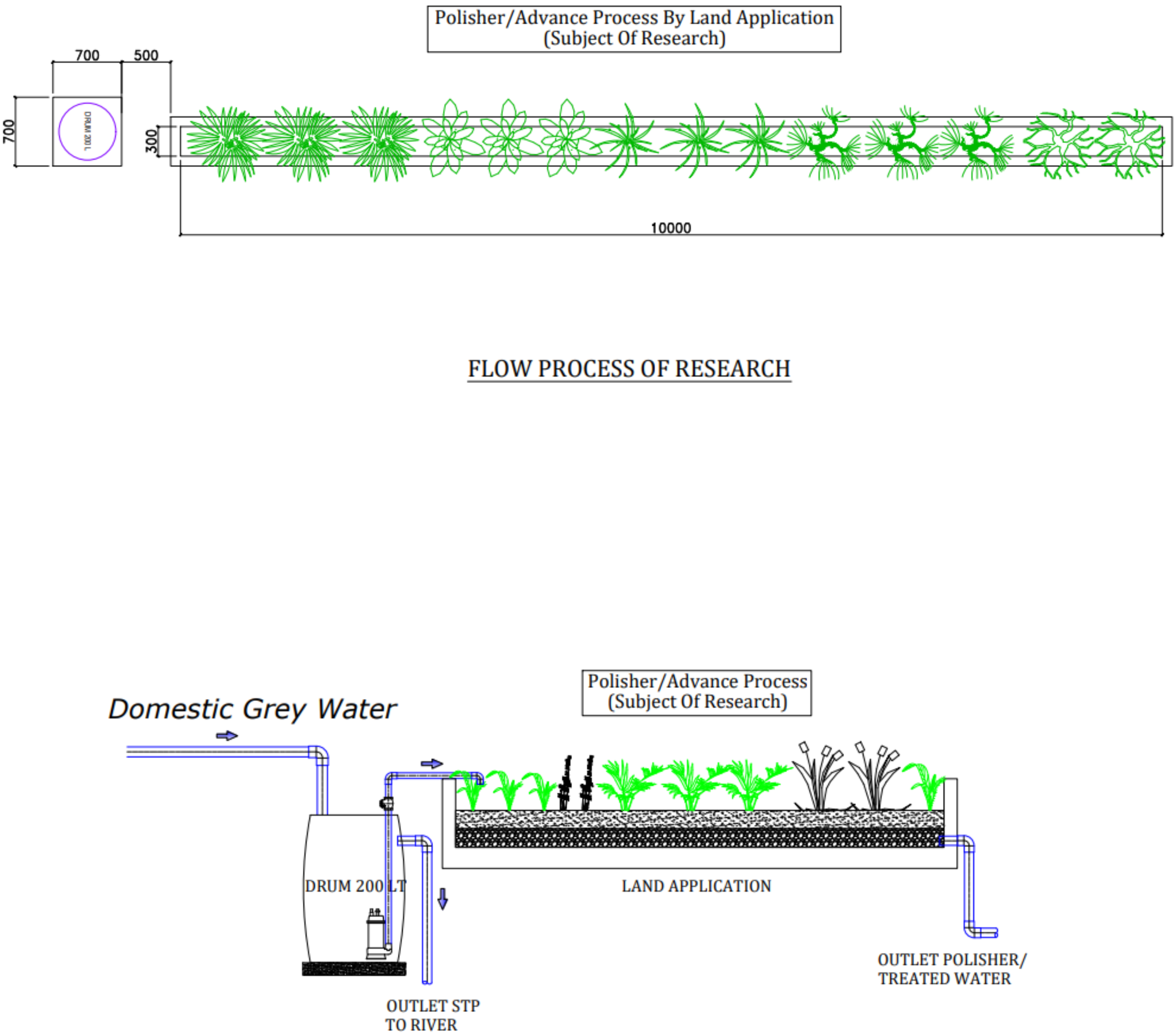

Figure 2. Research Design Process Flow

Figure 3. Research design

Result and Discussion

pH Value

The stability of pH is a crucial parameter in the success of biological processes within natural filtration systems (Ncube et al., 2018). As shown in the research table.

Table 1. pH value result

Day-	Q l/h	pH Inlet mg/l	pH Outlet mg/l
2	5.25	6.85	8.20
4	2.63	6.85	8.14
6	1.75	6.85	7.21
8	1.31	6.85	6.89
10	1.05	6.85	6.85

As shown in the research table above, the pH of the inlet remained stable at 6.85 from day 2 to day 10. The outlet pH value on day 2 was 8.20, continued on day 4 with a value of 8.14 mg/l, then on day 6 with a value of 7.21 mg/l, on day 8 with a value of 6.89 mg/l. In the last sampling, day 10, a value of 6.85 mg/l was obtained. These results indicate that the pH of domestic wastewater entering the constructed wetland system remained stable throughout the filtration process. Several factors influence pH during filtration, including microbial activities such as nitrification and denitrification, which can affect pH values. Plants absorb nitrate, ammonium, and phosphate most efficiently at neutral pH, as observed on day 10 when a neutral pH was achieved (Amanah et al., 2025).

COD Value

As shown in the research Table 2, the COD inlet values remained stable at 63.00 mg/L from day 2 to day 10. The COD Outlet day 2 obtained 44.25 mg/l with an efficiency of 29.77% continued on the 4th day obtained a value of 32.33 mg/l with an efficiency of 48.69% then on the 6th day obtained a value of 21.09 mg/l with an efficiency of 66.52% on the 8th day obtained a value of 18.34 mg/l with an efficiency of 70.89% on the last sampling, day 10 obtained a value of 8.48 mg/l with an efficiency of 86.54%. The highest efficiency was achieved on day 10, with a COD inlet of 63 mg/L and an outlet of 8.48 mg/L. The lowest efficiency was on day 2, with a COD inlet of 63 mg/L and an outlet of 44.25 mg/L. The reduction in COD is influenced by several factors, including the filtration of organic particles by the sandy soil media, the occurrence of chemical oxidation by dissolved oxygen in water with the presence of aerobic bacteria in the soil media can decompose organic materials through the reaction (Ihtiar et al., 2024).

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

Table 2. COD Result

Day-	Q (l/h)	COD Inlet (mg/l)	COD Outlet (mg/l)	Efficiency (%)
2	5.25	63.00	44.25	29.77
4	2.63	63.00	32.33	48.69
6	1.75	63.00	21.09	66.52
8	1.31	63.00	18.34	70.89
10	1.05	63.00	8.48	86.54

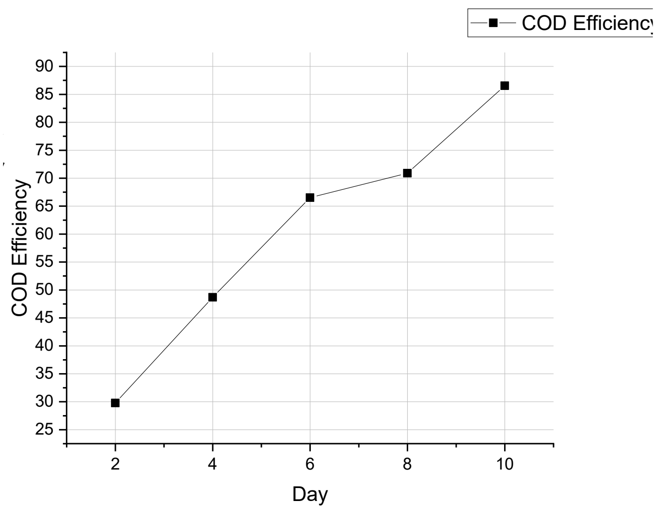

Figure 4. COD efficiency

Plant root surfaces serve as sites for microbial biofilm growth and absorb organic compounds as nutrients (Rudrappa et al., 2008). Retention time is a critical factor; longer retention allows for optimal biological processes and maximum nutrient uptake by plant roots.

Organic materials contained in artificial wastewater will be detected as COD which is a nutrient needed by plants that will grow microorganisms in the planting medium which will increase soil fertility which will later be absorbed by plant roots so that it becomes fertile (Amalia et al., 2022).

BOD Value

Table 3. BOD result

Day-	Q (l/h)	BOD Inlet (mg/l)	BOD Outlet (mg/l)	Efficiency (%)
2	5.25	13.00	9.22	29.09
4	2.63	13.00	6.73	48.20
6	1.75	13.00	4.39	66.20
8	1.31	13.00	3.82	70.61
10	1.05	13.00	1.77	86.41

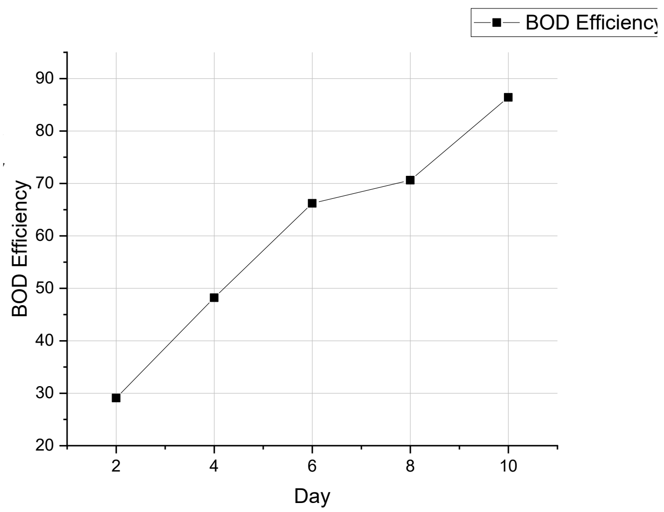

Figure 5. BOD efficiency

As shown in the research table above, the BOD inlet values remained stable at 13.00 mg/L from day 2 to day 10. the outlet BOD value on day 2 obtained a value of 9.22 mg/l with an efficiency of 29.09% continued on day 4 obtained a value of 6.73 mg/l with an efficiency of 48.20% then on day 6 obtained a value of 4.39 mg/l with an efficiency of 66.20% on day 8 was obtained a value of 3.82mg/l with an efficiency of 70.61% on the last sampling, namely day 10 obtained a value of 1.77 mg/l with an efficiency of 86.41%. The highest efficiency was achieved on day 10, with a BOD inlet of 13 mg/L and an outlet of 1.77 mg/L. The lowest efficiency was on day 2, with a BOD inlet of 13 mg/L and an outlet of 9.22 mg/L. The main factors affecting BOD reduction are retention time and flow rate. On day 2, the short retention time resulted in suboptimal biological processes, while on day 10, the longer retention time allowed for optimal absorption by plant roots and the entrapment of suspended particles in soil pores, facilitating biological activity by aerobic bacteria (Kadlec & Wallace, 2009) in the sandy soil media will oxidize dissolved organic matter using oxygen:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

The organic materials contained in artificial wastewater will be detected as COD and BOD. Those are nutrients needed by the plants that will grow microorganisms in the planting medium that eventually increase soil fertility, later to be absorbed by plant roots so that it becomes fertile (Amalia et al., 2022).

Nitrate Value

Table 4. Nitrate result

Day-	Q (l/h)	NO_3 Inlet (mg/l)	NO_3 Outlet (mg/l)	Efficiency (%)
2	5.25	18.56	3.60	80.60
4	2.63	18.56	1.50	91.92
6	1.75	18.56	1.40	92.46
8	1.31	18.56	0.80	95.69
10	1.05	18.56	0.20	98.92

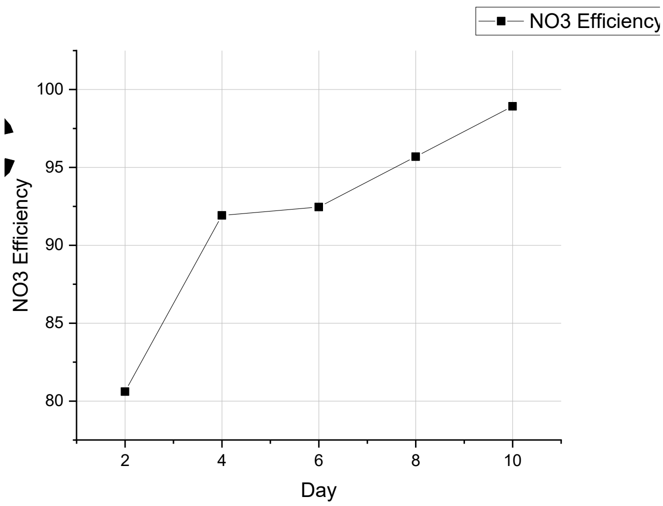

Figure 6. Nitrate efficiency

The variation in nitrate values is influenced by factors such as the type of soil media, biological processes or microbial activity in the planting media, retention time, and water flow rate. Plants absorb nitrogen in the form of nitrate. As shown in Table 4, the nitrate inlet values remained stable at 18.56 mg/L from day 2 to day 10. followed by an outlet nitrate value of day 2 of 3.60 mg/l with an efficiency of 80.60%, followed by a value of 1.50 mg/l with an efficiency of 92.92% on day 4, a value of 1.40 mg/l with an efficiency of 92.46% was obtained on day 6, a value of 0.80 mg/l with an efficiency of 95.65% was obtained on the last sampling, namely day 10, a value of 0.20 mg/l with an efficiency of 98.92% was obtained. The highest efficiency was achieved on day 10, with a nitrate inlet of 18.56 mg/L and an outlet of 0.20 mg/L. The lowest efficiency was on day 2, with a nitrate inlet of 18.56 mg/L and an outlet of

3.60 mg/L. Longer retention time enhances biological processes, reducing nitrate concentrations in wastewater and allowing for more optimal absorption by plant roots, which also support microbial growth. Lower flow rates increase retention time, enabling more nitrate to be absorbed by plants and increasing nitrate removal efficiency.

Phosphate Value

Table 5. Phosphate result

Day-	Q (l/h)	PO_4 Inlet (mg/l)	PO_4 Outlet (mg/l)	Efficiency (%)
2	5.25	22.47	12.93	42.45
4	2.63	22.47	3.71	83.49
6	1.75	22.47	1.93	91.41
8	1.31	22.47	0.80	96.44
10	1.05	22.47	0.48	97.86

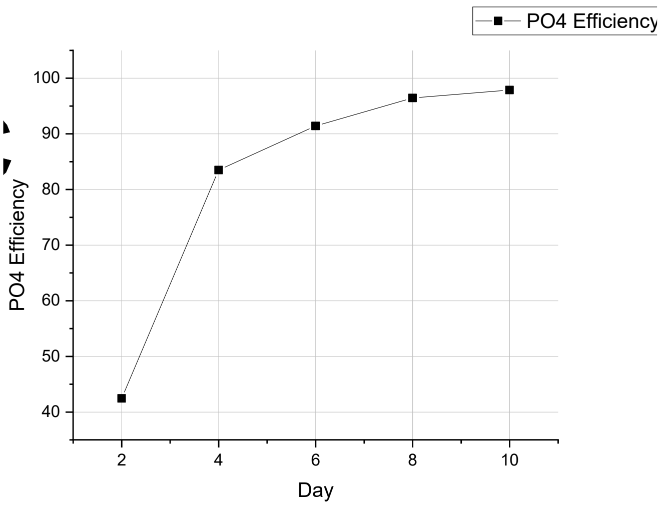

Figure 7. Phosphate efficiency

The reduction in phosphate values is influenced by factors such as the type of soil media, biological activity or microbial presence in the planting media, retention time, and phosphate concentration. In this experiment, phosphate was represented by phosphate compounds. The forms of phosphate absorbed by plants are $H_2PO_4^-$ and HPO_4^{2-}, with $H_2PO_4^-$ dominating in acidic to neutral soils (pH ≤ 7) and HPO_4^{2-} in alkaline soils. As shown in Table 5, the phosphate inlet values remained stable at 22.47 mg/L from day 2 to day 10. The phosphate outlet value was 12.93 mg/l on day 2 with an efficiency of 42.45%, followed by a value of 3.71 mg/l on day 4 with an efficiency of 83.49%, then on day 6 a value of 1.93 mg/l was obtained with an efficiency of 91.41% on day 8 a value of 0.80 mg/l was obtained with an efficiency of 95.44% on the last sampling, day 10, a value of 0.48 mg/l was obtained with an efficiency of 97.86%. It can be seen that the highest efficiency that can be achieved is 97.86% on day 10 with an inlet PO_4 of 22.47 mg/l and an outlet PO_4 of 0.48 mg/l and the lowest efficiency process value was obtained on day 2 at 42.45% with PO_4 inlet 22.47 mg/l and PO_4 outlet 12.93 mg/l The mechanism reduction of phosphate is influenced by microbial activity and the adsorption of phosphate ions onto soil particles through chemical bonding through chemical bonds:

$$Fe(OH)_3 + PO_4^{3-} \rightarrow FePO_4 + 3OH^-$$

The source of P for plants in Phosphate ions serve as a nutrient source for plants, and longer retention times allow for more optimal absorption by plant roots (Siswandari et al., 2016). Retention time is a factor that influences the reduction of phosphate. Research has shown that a longer retention time will optimize the reduction of phosphate caused by greater absorption by plants, which is increasingly optimal (Rezania et al., 2021).

Ammonia Value

Table 6. Ammonia result

Day-	Q (l/h)	NH_3 Inlet (mg/l)	NH_3 Outlet (mg/l)	Efficiency (%)
2	5.25	19.02	0.80	95.79
4	2.63	19.02	0.09	99.53
6	1.75	19.02	0.03	99.84
8	1.31	19.02	0.03	99.84
10	1.05	19.02	0.03	99.84

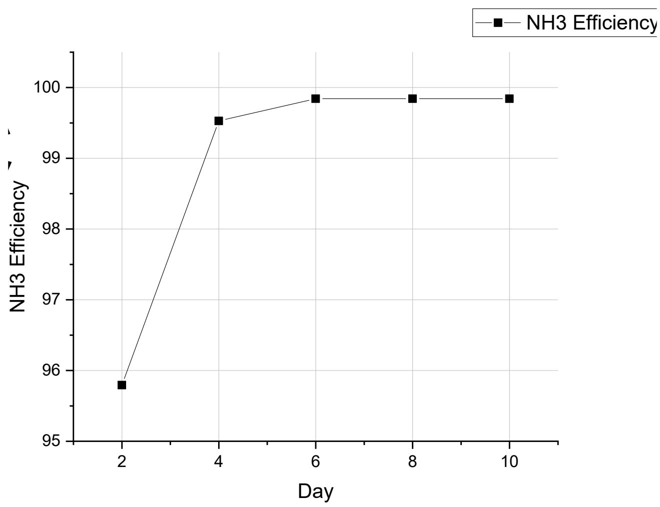

Figure 8. Ammonia efficiency

Wastewater containing ammonia in the presence of abundant oxygen promotes the growth of Nitrosomonas bacteria, which oxidize ammonia to nitrite and then to nitrate, resulting in decreased ammonia concentrations. High ammonia concentrations can inhibit the growth of Nitrobacter bacteria, but if the pH is < 7, Nitrobacter can still grow (Viani, 2022). As shown in Table 6, the ammonia inlet values remained stable at 19.02 mg/L from day 2 to day 10. The ammonia outlet value were 0.80 mg/l on day 2 with an efficiency of 95.79%, followed by a value of 0.09 mg/l with an efficiency of 99.53% on day 4, a value of 0.03 mg/l with an efficiency of 99.84% was obtained, then on day 6, a value of 0.03 mg/l with an efficiency of 99.84% was obtained on day 8, a value of 0.03 mg/l with an efficiency of 99.84% was obtained on the last sampling, day 10, a value of 0.0.3 mg/l with an efficiency of 99.84% was obtained. The highest efficiency that can be achieved is 99.84% on the 8th and 10th days with inlet ammonia of 19.02 mg/l and outlet ammonia of 0.03 mg/l at this point the ammonia value has reached its optimal capacity point. The lowest efficiency was on day 2, with an ammonia inlet of 19.02 mg/L and an outlet of 0.80 mg/L. The reduction in ammonia is mainly due to nitrification, NH_3 into nitrite NO_2^- and then into nitrate NO_3^- by nitrifying bacteria in the planting media. This process is effective with sufficient retention time. *Heliconia psittacorum* plants also absorb ammonia and other nitrogen compounds through their roots as nutrients for growth (Gómez-Merino et al., 2012). A small portion of ammonia may be adsorbed onto soil particles. Treatment efficiency increases with longer retention times.

TSS Value

Table 7. TSS result

Day	Q (l/h)	TSS Inlet (mg/l)	TSS Outlet (mg/l)	Efficiency (%)
2	5.25	29.40	4.00	86.39
4	2.63	29.40	5.00	82.99
6	1.75	29.40	10.00	65.99
8	1.31	29.40	24.00	18.37
10	1.05	29.40	16.00	45.58

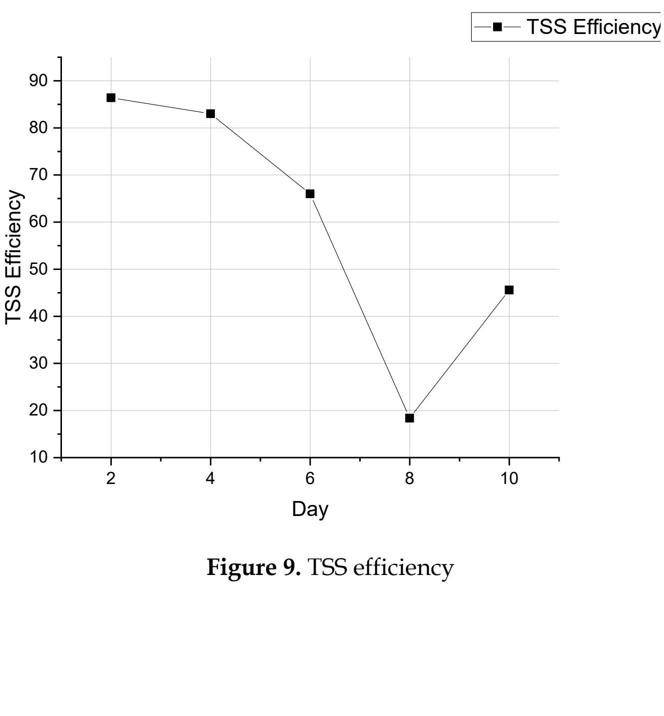

Figure 9. TSS efficiency

In the experimental results there are differences in values based on several factors, namely the soil media used, biological activity or microorganisms in the planting media, the effect of residence time and water discharge. The experimental results are shown in table 13. From the table, it can be seen that the greatest efficiency that can be achieved is 86.39% in the first sample on the 2nd day with an inlet TSS of 29.40 mg/l and an outlet TSS of 4 mg/l. In the second and third samples, namely on days 4 and 6, the efficiency began to decrease. This condition is estimated to be a factor of microorganisms starting to grow in the soil. In the early phase of microorganism growth, which is called young microorganisms, the form of bacteria is small or commonly known as free- swimming bacteria and cannot group well with other young microorganisms so that the TSS value increases over time (Aguirre & Koutsoumanis, 2016).

In the fourth sample, on day 8, there was an extreme increase in value, the TSS value became 24 mg/l with an efficiency of 18.37%, whereas the TSS value in the previous experiment on the 6th day and after that on the 10th day the value was 10 mg/l and 16 mg/l or at an efficiency value of 18.37% and 45.58% respectively. These conditions can be caused by the loss of the planting media, thereby increasing the TSS value that comes out of the wetland.

On the 10th day, the microorganisms matured and began to form clusters together so that they could be retained in the pores of the soil in their growing media. Mature microorganisms outside their cell walls will form a layer of polysaccharides as a food reserve for bacteria. The nature of polysaccharides is fast so that they easily stick to one bacteria to one another (Angelin & Kavitha, 2020). It can be seen that the TSS value on the 10th day has decreased and efficiency has increased compared to previous days.

Comparison of Processed Water Quality with Quality Standards

It showed on the Table 8 that the pH analysis has been in accordance with the quality standards of class 2 and class 3 for COD that has entered the quality standards of class 2 and class 3 is on the 6th to 10th day on the 2nd day COD has not entered the quality standards of class 3 on the 4th day the COD value enters the quality standards of class 3. The BOD value on days 2 and 4 does not enter the quality standards of class 3 on days 6-8 the BOD value enters the quality standards of class 3 which is 6 mg/l on the 10th day the BOD value has entered the quality standards of class 2 which is 3 mg/l. for the Nitrate value, a good nitrate value is produced, which has met the quality standards of class 2 and class 3, namely with values of 10 mg/l and 20 mg/l respectively. The phosphate value on days 8 and 10 enters the quality standards of class 3, namely ≤ 1 mg/l. Ammonia produced on days 2 to 10 produced good values, it has entered the class 2 and class 3 quality standards, all with values ≤ 0.2 mg / l for TSS values on days 2 to 10 have entered the class 2 and class 3 quality standards, with values ≤ 50 mg / l. It can be concluded that the natural filtration system using *Heliconia psittacorum* plants and Napier grass is effective in reducing domestic wastewater pollutants to meet class 3 quality standards for all parameters on day 10 because this system requires time to adapt and requires periodic media maintenance to maintain optimal performance.

Table 8. Processed water quality with quality standards

Day	Parameter		Quality Standards	
	pH in	pH out	Class 2	Class 3
2	6.85	8.20	6 - 9	6 - 9
4	6.85	8.14	6 - 9	6 - 9
6	6.85	7.21	6 - 9	6 - 9
8	6.85	6.89	6 - 9	6 - 9
10	6.85	6.85	6 - 9	6 - 9
	COD in	COD out	Class 2	Class 3
2	63.00	44.25	25	40
4	63.00	32.33	25	40
6	63.00	21.09	25	40
8	63.00	18.34	25	40
10	63.00	8.48	25	40
	BOD in	BOD out	Class 2	Class 3
2	13.00	9.22	3	6
4	13.00	6.73	3	6
6	13.00	4.39	3	6
8	13.00	3.82	3	6
10	13.00	1.77	3	6
	NO_3 in	NO_3 out	Class 2	Class 3
2	18.56	3.60	10	20
4	18.56	1.50	10	20
6	18.56	1.40	10	20
8	18.56	0.80	10	20
10	18.56	0.20	10	20
	PO_4 in	PO_4 out	Class 2	Class 3
2	22.47	12.93	0.2	1
4	22.47	3.71	0.2	1
6	22.47	1.93	0.2	1
8	22.47	0.80	0.2	1
10	22.47	0.48	0.2	1
	NH_3 in	NH_3 out	Class 2	Class 3
2	19.02	0.80	0.2	0.5
4	19.02	0.09	0.2	0.5
6	19.02	0.03	0.2	0.5
8	19.02	0.03	0.2	0.5
10	19.02	0.03	0.2	0.5
	TSS in	TSS out	Class 2	Class 3
2	29.40	4.00	50	100
4	29.40	5.00	50	100
6	29.40	10.00	50	100
8	29.40	24.00	50	100
10	29.40	16.00	50	100

Conclusion

Based on the results of this study, it can be concluded that the natural filtration system using *Heliconia psittacorum* plants (*Heliconia psittacorum*) and Napier grass (*Pennisetum purpureum*) is effective in improving the quality of domestic wastewater. The system demonstrated significant reductions in key pollutant parameters, including COD, BOD, nitrate, phosphate, ammonia, and TSS. By the tenth day of treatment, the effluent on day 10 met the Class 3 and Class 2 water quality standards for all measured parameters like pH, COD, BOD, NH_3, NO_3, PO_4 and TSS, stipulated in Indonesian environmental regulations. The effectiveness of the system is influenced by several factors, such as the type of soil media, the biological activity of microorganisms, retention time, and flow rate. The adaptation period of the system is crucial, as optimal pollutant removal was observed after several days of operation, highlighting the importance of sufficient retention time. Regular maintenance of the filtration media is also necessary to sustain optimal performance and prevent clogging or media loss. In general, this natural filtration method offers a sustainable, low-cost because of the materials is easy to get and environmentally friendly solution for domestic wastewater treatment. It is suitable for application in areas with limited land availability and supports efforts toward sustainable water resource management and environmental protection.

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Author Contributions

Conceptualization, methodology, formal analysis, investigation, resources, data curation, and original draft writing, A.A.; validation, review and editing, and visualization, B.D.Z., H.S., and A.A. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest

The author declares that there is no conflict of interest, either between the authors or with the research objects discussed in this paper.

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