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PURIFICATION OF FISH POND WASTEWATER FOR REUSE

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ABSTRACT : This community service-based research is simply an effort to treat household wastewater to support the availability of clean water sources in urban areas. The type of waste treated here is *graywater* waste, which is wastewater that comes from kitchen and bathroom sink or washing water (not feces and urine). The reason for choosing the type of *graywater* waste is because of its high production, which is up to 70-75% of the total liquid waste generated from domestic activities.

The method used is a physical model in the laboratory using wastewater with a model scale that uses variations in discharge, number of vetiver stems and residence time.

The results of the study showed that the use of the filter model was able to improve the quality of wastewater, where the output produced met clean water quality standards, then it can be stated that the use of wastewater treatment filters using variations in water discharge, number of rods, and residence time is able to reduce pollutants contained in greywater waste.

Keywords: wastewater, reuse, purification

1. Introduction

The river water itself should still beused for various purposes, such as for agricultural and landscaping irrigation needs, washing vehicles and tools, and so on [1, 2, 3, 4]. Domestic waste makes the benefits of river water reduced, where river water when used can have a negative impact, such as disrupting the quality of plant growth and development if used for irrigation, and so on [5, 6, 7, 8].

Given the high production of domestic wastewater, as well as its high potential for pollution, the topic of sewage treatment will always be needed as one of the solutions that can be pursued. Various previous studies have formulated various waste treatment technologies that are easy to apply and have the potential to produce optimal outcomes through various approaches [8]. One approach that is currently being developed is the utilization of aquatic plants as phytoremediators [9, 10]. Sewage treatment media equipped with aquatic plants are not only able to precipitate or filter pollutants, but can also improve the treatment process because pollutants are absorbed by plant roots [11].

Vetiver grass (*Vetiveria zizanioides*), or locally known as vetiver grass, is one type of aquatic plant that has been growing wildly so that it is easily found [12]. The potential of vetiver grass not only can be utilized as handicrafts and ornamental plants, but can also be utilized as a wastewater remediator agent [13, 14]. This potential has been proven from various research [15]. This potential can be a very good solution for the fulfillment of clean water, especially in urban areas.

This community service-based research is simply an effort to treat household wastewater to support the availability of clean water sources in urban areas. The type of waste treated here is *graywater* waste, which is wastewater that comes from kitchen and bathroom sink or washing water (not feces and urine) [16]. The reason for choosing the type of *graywater* waste is because of its high production, which is up to 70-75% of the total liquid waste generated from domestic activities [17]. Generally, *graywater* wastewater is directly discharged through the drainage system and of course leads to the river [18]. So it is quite unfortunate if this high quantity is not sought to be reprocessed so that it can be utilized for various purposes. The Pohain community managed to innovate and develop an educational village. "There are innovations, apart from those that are in accordance with the SOP (operational standard), which were developed by the community itself, one of which is an educational resilient village [19].

2. Research Method

Tilapia pond wastewater treatment and its output is processed into clean water to improve water quality so that it can be reused. To provide a clear picture of how the variables in this study interact with each other, a conceptual framework of the study is made based on the background, problems and objectives of the study: background, problems and objectives of the study.

The variable in this study include the following:

1. Free Variable

   Stay time (2 days, 4 days, 7 days)

   Where each is distinguished based on the number of stems of *vetiver* plants with soil media and phytoremidiation (without media), the plants used in *wetland*, namely *vetiver* plants (*Vetiveria zizanoides*).

2. The dependent variable consists of selected parameters, namely Color.

As for the quality standards of each parameter above referring to the Minister of Health Regulation No. 2 of 2023 concerning Hygiene and sanitation (clean water), the Research Parameters are described as follows:

Table 1 Clean Water Quality Standard Research Parameters

No.	Parameters	Cl Clean water standard	Unit
1	Color	10	TCU

Source: Government Regulation of the Republic of Indonesia Number 2 of 2023.

The standard table for clean water quality based on government regulations is for color with a value of 10 TCU (True Color Unit). So in the study, data must be taken before and after processing with results that must be below the value of 10 TCU.

2.1 Research Hypothesis

The hypothesis to be proven in this study is as follows:

1. The filter material used has a significant influence on the quality of the treated wastewater.
2. The use of a *wetland* system by utilizing
3. vetiver plants provides better wastewater treatment results based on the number of stems used.
4. Length of residence time has a significant influence on the quality of treated wastewater, both in the filtration process using *wetlands*.
5. The physical model of sewage treatment is able to improve the quality of wastewater to meet clean water criteria and variations in discharge.

2.2 Operational Definition

1. A physical model is an imitation of a natural event or a prototype in the field that is formed using a physical model in the laboratory.
2. *Grey water* is the colored tilapia pond waste water from the pond *output* that is directly discharged into the river.
3. Filter is a material or material used to filter wastewater effluent with the aim of improving water quality until it is suitable for disposal.
4. *Constructed* wetland is an artificial wetland planted with aquatic plants as a wastewater remediation agent. *Wetlands* are made in two kinds, namely those planted with *Vetiver* Root (*Vetiveria zizanioides*) as a phytoremediation agent for *graywater* waste.

2.3 Building Model Planning

The building model is planned using a scale ratio of 1: 100, with a discharge scale. For the *wetland*, 2 boxes were made with the aim of comparing between the two media, namely *vetiver* plants (*Vetiveria zizanioides*) with media and without media. The box has a size (70 x 30 x 30 cm) of 2 pieces for vetiver plants. In this physical model using waste discharge taken from the *output of* the fish pond so that the actual discharge is also modeled because it adjusts the conditions of the existing laboratory site.

Material :

1. Water Reservoir
2. 2 *wetland* filter boxes (hand washing sink plastic material)
3. Estimator Glass (to see the water level)
4. Faucet with a diameter of ¾"

In figure 1 is phytoremediation, namely plants without soil media with variations in residence time, number of vetiver stems, and variations in discharge.

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Figure 1 *Phytoremidiation wetland* filter box

Figure 2 *Wetland* filter box with media

In figure 2 are plants with soil media and submerged in water left for several days (residence time), variations in discharge and number of vetiver stems.

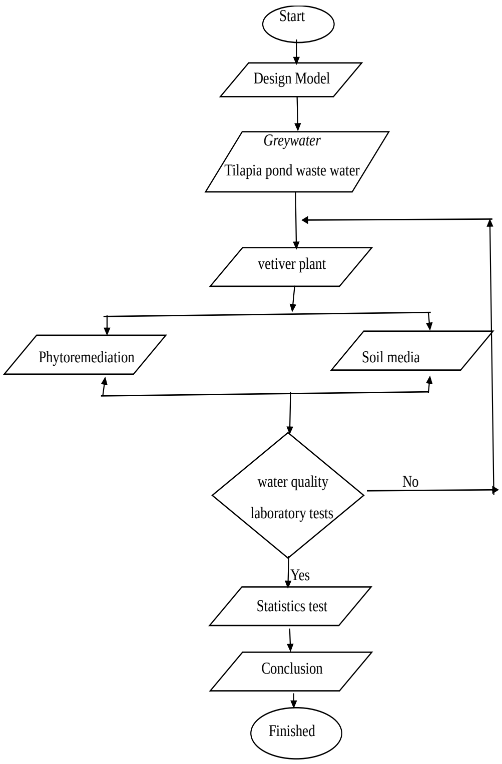

Figure 3 Flow Chart

In figure 3 the flow diagram is the flow of research treatment, namely from taking water samples, preparing plants and doing it in 2 ways, namely phytoremediation and soil media. From the results of processing the comparison with the two methods, continue to statistics and conclusions.

2.4 Result and Discussion

Comparison of Model Experiment of Vetiver with Waterlogged Soil and Phytoremidiation (without soil media). *Greywater* sewage treatment design with a scale model using soil as a water-soaked medium with variations in discharge, residence time and the amount of vetiver used

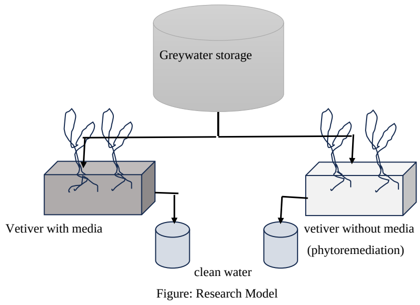

Figure 4 Research Model

2.5 Color parameters of Fragrant Root with soil media

Table 2 Greywater effluent treatment results with submerged soil media, color (10 TCU)

Number of AW Stems	Water Discharge (liter/day)	Grey water	Staying Time		
			2 days	4 days	7 days
50	1000 liters/day	34,63	30,0	20,0	**12,0**
	1500 liters/day	34,63	30,0	19,8	**12,0**
	2000 liters/day	34,63	28,5	20,2	**11,9**
100	1000 liters/day	34,63	27,6	18,2	**11,3**
	1500 liters/day	34,63	27,6	18,4	**10,7**
	2000 liters/day	34,63	29,0	17,7	**11,5**
150	1000 liters/day	34,63	25,4	16,4	**10,4**
	1500 liters/day	34,63	24,4	15,6	**10,8**
	2000 liters/day	**34,63**	**26,7**	**16,2**	**10,6**

In table 2 in column 1 is the number of stems of vetiver plants with 3 variations of the number of stems of vetiver (AW). In column 2 is the debit. Debit of 1000, 1500, 2000 (liters/day) is carried out on 50 stems of vetiver plants. Then the processed water is taken which turns out not to meet the requirements for clean water, then it is repeated in the same way and the number of stems is increased to 100 and 150. At the number of stems 150 with an age of 7 days, the results are close to the Permenkes standard, namely 10.6

TCU, while the color value of the initial greywater is 34.63 TCU

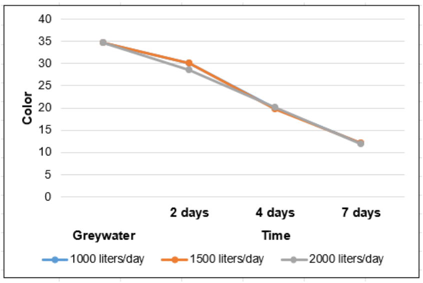

Figure 5 Color Chart Based on Water Discharge and Residence Time with 50 Stems

The results of the color parameter description show that with the number of vetiver stems as many as 50 stems and each addition of water discharge at different residence time periods will be able to reduce the color value.

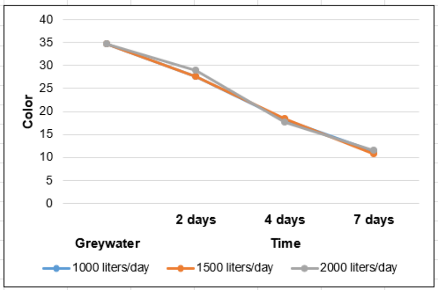

Figure 6 Color Chart Based on Water Discharge and Residence Time with 100 Stems.

The results of the color parameter description show that with the number of vetiver stems as many as 100 stems and each addition of water discharge at different residence time periods will be able to reduce the color value.

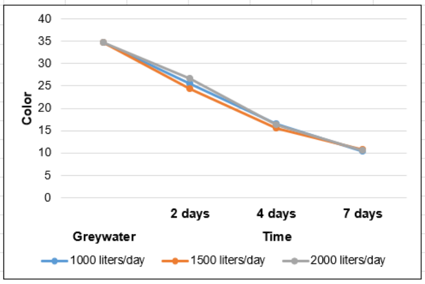

Figure 7 Color Chart Based on Water Discharge and Residence Time with 150 Stems.

The results of the color parameter description show that with the number of vetiver stems as many as 150 stems and each addition of water discharge at different residence time periods will be able to reduce the color value.

2.6 Color Parameters of Vetiver with Fitoremediation

In table 3 in column 1 is the number of stems of vetiver plants with 3 variations of the number of stems of vetiver (AW). In column 2 is the debit. Debit of 1000, 1500, 2000 (liters/day) is carried out on 50 stems of vetiver plants. Then the processed water is taken which turns out not to meet the requirements for clean water, then it is repeated in the same way and the number of stems is increased to 100 and 150. At the number of stems 150 with an age of 7 days, the results are close to the Permenkes standard, namely 8.7 TCU, while the color value of the initial greywater is 34.63 TCU and the results are better using Phytoremediation

Table 3 Treatment Results of *Greywater* ffluent with Color Phytoremediation (10 TCU)

Number of AW Stems	**Water Discharge (liter/day)**	**Grey water**	**Staying Time**		
			2 days	**4 days**	**7 days**
50	1000 liters/day	34,63	30,2	15,6	**9,8**
	1500 liters/day	34,63	30,2	14,8	**10,3**
	2000 liters/day	34,63	28,7	15,4	**10,0**
100	1000 liters/day	34,63	28,1	14,2	**9,0**
	1500 liters/day	34,63	27,5	14,2	**8,9**
	2000 liters/day	34,63	28,4	14,3	**8,7**
150	1000 liters/day	34,63	25,3	13,3	**8,7**
	1500 liters/day	34,63	25,8	12,8	**8,7**
	2000 liters/day	**34,63**	**24,0**	**13,7**	**8,7**

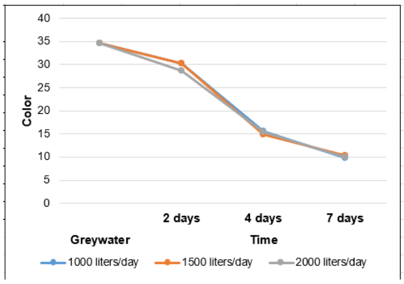

Figure 8 Color Chart Based on Water Discharge and Residence Time with 50 Stems.

The results of the color parameter description show that with the number of vetiver stems as many as 50 stems and each addition of water discharge at different residence time periods will be able to reduce the color value.

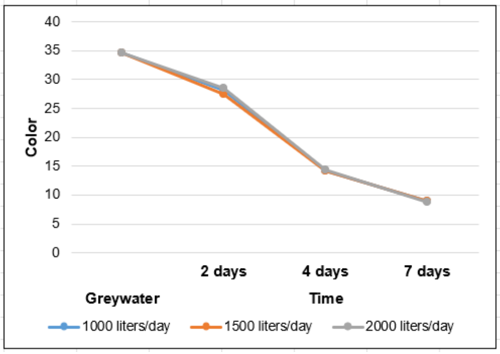

Figure 9 Color Graph Based on Water Discharge and Residence Time with Number of Stems 100

The results of the color parameter description show that with the number of vetiver stems as many as 100 stems and each addition of water discharge at different residence time periods will be able to reduce the color value.

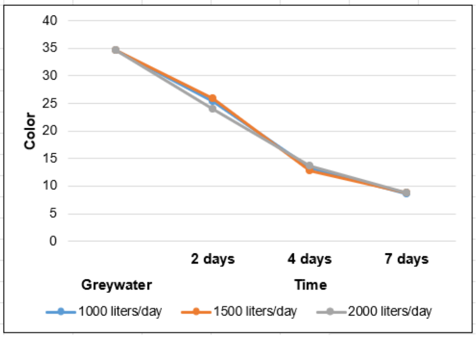

Figure 10 Color Graph Based on Water Discharge and Residence Time with Number of Stems 150

The results of the color parameter description show that with the number of vetiver stems as many as 150 stems and each addition of water discharge at different residence time periods will be able to reduce the color value.

3. Conclusions

There are several obstacles faced in this study, namely: Technical obstacles on the model scale by determining the optimal technical parameters, such as vetiver density, water residence time and land requirements on a model scale to obtain maximum results. The influence of climate change, which can affect the growth of vetiver and the performance of the water treatment system. The vetiver testing process takes quite a long time because of its biological nature that works gradually, thus extending the research time. From these obstacles, it can be concluded that greywater tilapia pond waste is a type of wastewater that comes from fish waste so that it requires proper processing before finally being discharged into the river. So far, greywater waste has been carried out by flowing directly into the river. This study aims to increase the effectiveness of greywater liquid waste processing by using a physical model consisting of 2 processing processes, namely wetland. Vetiver with submerged soil media and phytoremediation.

This study applies a filter using vetiver plant media, using variations in water discharge, number of stems, and residence time of the filter. The research variables observed were color. The method used in data analysis was a linear regression test using the SPSS version 26 program. The results of the study showed that the use of the filter model was able to improve the quality of wastewater, where the output produced had met the clean water quality standards of the Minister of Health Regulation no. 2 of 2023. Thus, it can be stated that the use of wastewater treatment filters using variations in water discharge, number of stems, and residence time is able to reduce pollutants contained in greywater wastewater of tilapia ponds and the results are better Phytoremediation

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