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Effectivity of Phytoremediation in Liquid Waste Treatment BHAKTI WIRA TAMTAMA HOSPITAL in SEMARANG

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ABSTRACT: This research entitled "Effectiveness of phytoremediation by using water jasmine, lotus and fragrant roots in reducing levels of phosphate in hospital liquid waste" aims to determine the effectiveness of phytoremediation on wastewater treatment in Bhakti Wira Tamtama Hospital Semarang. The independent variable of this study is the type of plant and the weight of the plant with the quality of phosphat effluent content as the dependent variable. The population in the study was the effluent of the Waste Water Treatment Plant at Bhakti Wira Tamtama Hospital. Samples are phosphate-containing wastewater obtained in hospital influent ponds as a medium to grow water jasmine plants, lotus and fragrant roots. Samples were taken on day 6 with 3 aquatic plants and different plant weights of 200 gr / 1, 400 gr / 1, 600 gr / 1, which were 81 samples per plant. The research analysis used was General Linear Model Univariate-Covariate (GLM). The results showed that: 1) there was a significant difference in the level of phosphate reduction according to the type of water jasmine plant, lotus and vetiver; 2) there is a significant difference in the level of phosphate reduction according to the weight of plants 200 gr, 400 gr and 600 gr; 3) there is a significant difference in the decrease in phosphate levels according to the interaction between plant species and plant weight, where the lotus plant weight of 600 gr is the most effective combination interaction in reducing the levels of phosphate in wastewater at Bhakti Wira Tamtama Hospital, Semarang City. The research recommendation is that Hospital Management can implement liquid waste management with phytoremediation methods to support government programs as environmentally friendly hospitals. Besides that, lotus plants can be used as a medium for the application of phytoremediation methods.

KEYWORDS: Phytoremediation, Aquatic Plants, Plant Weight, Hospital Liquid Waste Treatment

I. INTRODUCTION

Hospital activities have the potential to produce waste that can cause environmental pollution. Therefore, it is necessary to control the disposal of liquid waste that is discharged into the environment, with the hope that it can reduce the pollution with good waste management and in accordance with the prevailing laws and regulations.

Environmentally friendly Hospital activities focus on the demands of service needs from hospital customers who have shifted towards a comprehensive service based on the comfort and safety of the hospital environment.

High phosphate in the environment can affect the balance of aquatic ecosystems, because the availability of dissolved oxygen in the water decreases due to absorption by algae that thrives and can interfere with the oxygen binding process by blood in aquatic biota. Thus, it is necessary to analyze the causes so that a reduction solution can be made, so as not to pollute the environment too often. In large quantities, phosphate can cause nutrient enrichment (eutrophication) in river water bodies.

Phytoremediation is a new green technology that developed in the early 1990. This is marked by the success of remediating and re-collecting radioactive substances Cs, Sr, and U from polluted areas in Chernobil by using *Heliantus Annus* (sunflower) plants.

Based on the results of the WWTP outlet test at Bhakti Wira Tamtama Hospital, the results of phosphate levels in July 2017 before phytoremediation was 4.12 mg / l where the results exceeded the quality standards required by the Central Java Provincial Regulation Number 5 of 2012 concerning quality standards. Hospital outlet waste water is the maximum phosphate level of 2 mg / l.

The use of aquatic plants as phytoremediators has received a lot of attention lately. Water plants that can function as phytoremediators include water jasmine, lotus and fragrant roots. Jasmine water (*Echinodorus paleotolius*) is an ornamental plant that can grow well in the tropics. This plant is able to adapt well. The high amount of nitrate in the waters can be reduced by the use of water jasmine plants (*Echinodorus paleotolius*).³ Lotus is a type of aquatic plant found in many lake waters in Indonesia. In addition, the beautiful shape of the lotus leaves can support the aesthetic function of the environment. if used as a medium in wastewater treatment. Vetiver can grow in all types of soil, this 1-1.5 meter high grass has a 3 (three) meter root that has high absorption.

Based on the description above, it is necessary to study the effectiveness of phytoremediation by using water jasmine, lotus and vetiver in reducing phosphate levels in hospital wastewater.

II. METHOD

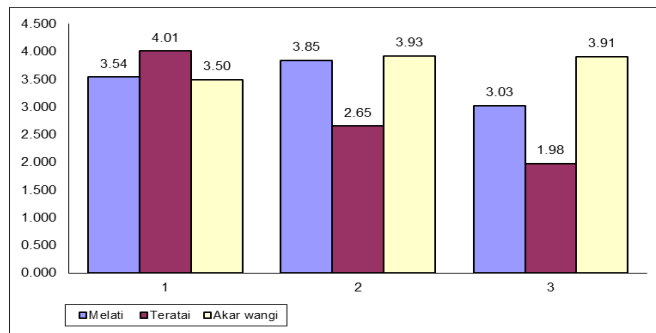
This study uses a quasi-experimental method (quasi experiment research) which aims to reveal a causal relationship by involving the control group in addition to the experimental group, sorting the two groups random techniques with a randomized block design.

III. RESULT

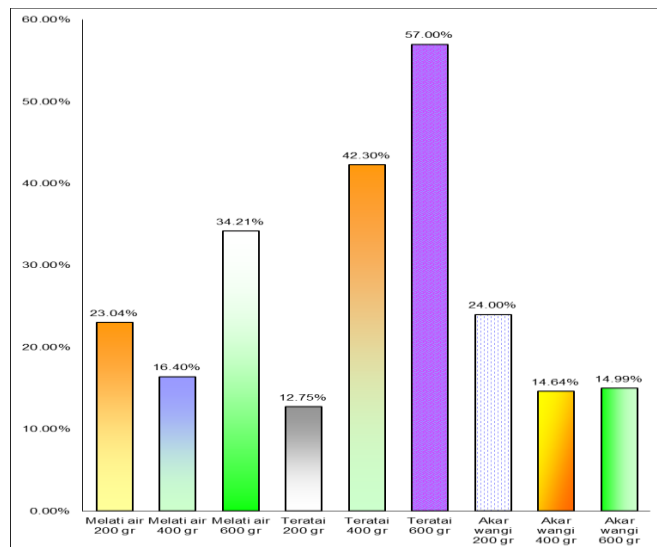
The results of examination of phosphate levels before fitoremiiation were 4.60 mg / l. The results after phytoremediation are as presented below.

Repetition	POSPAT LEVEL								
	Water Jasmine			Lotus			Fragrant root		
	200 gr	400 gr	600 gr	200 gr	400 gr	600 gr	200 gr	400 gr	600 gr
1	3.60	3.37	3.25	4.48	3.28	2.25	3.28	4.12	4.32
2	3.11	3.49	3.21	2.49	3.11	2.12	3.50	4.12	4.50
3	4.32	3.42	3.25	3.87	3.03	1.88	3.02	4.12	3.28
4	3.22	4.22	3.03	3.76	3.03	1.98	3.27	4.22	4.52
5	4.58	3.22	3.12	4.21	2.02	2.00	3.11	3.02	4.33
6	3.35	4.22	3.60	4.32	2.34	1.90	3.24	3.01	4.19
7	3.23	4.32	3.25	4.09	3.12	1.73	4.22	4.23	3.56
8	3.33	4.09	2.18	4.89	2.01	1.94	3.52	4.19	3.32
9	3.11	4.27	2.35	4.01	1.98	2.01	4.31	4.32	3.17
Average	3.54	3.85	3.03	4.01	2.65	1.98	3.50	3.93	3.91
Min	3.11	3.22	2.18	2.49	1.98	1.73	3.02	3.01	3.17
Max	4.58	4.32	3.60	4.89	3.28	2.25	4.31	4.32	4.52
Std deviasi	0.54	0.46	0.46	0.67	0.56	0.15	0.46	0.52	0.57

Table 4.2 shows that each sample tends to decrease in water jasmine plants, lotus and fragrant roots ranging from 200 grams, 400 grams, and 600 grams.



Comparison of the level of reduction of phosphate levels based on the weight of plants on water jasmine plants, lotus and vetiver which are in accordance with the required quality standards indicated by lotus plants weighing 600 gr, with an average decrease of 1.98 mg / l.



The graph above shows that the interaction of lotus plants with a weight level of 600 grams is the most effective in reducing the amount of liquid waste phosphate in hospitals. Bhakti Wira Tamtama, where the level of phosphate reduction is able to reach 57 percent.

In this study, researchers repeated 9 times in the hope of giving more tangible and accurate results.

On the first day to the sixth day the temperature is measured with an average temperature of 26.4 ° C. In the first stage, all types of plants are already in an acclimatized condition so that the plants absorb and oxidize the waste in which there is organic matter. After the waste water is inserted, monitor it.

The phytoremediation process is an alternative to overcome Phosphate reduction problems. In this process some water plants are used which can help in the phytoremediation process. This process provides an opportunity to reduce Phosphate content, considering several advantages of the method.

The possibility of a difference in the decline that occurs lies in several things including the inequality of the location and condition of the plant during the phytoremediation process where for 6 days due to the limitations of the plant there are protected by other trees and some are directly exposed to the sun so that the estimated temperature difference



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affects the quality of plants, besides the quality and number of leaves from water jasmine plants and also the poor absorption ability of vetiver plants.

IV. CONCLUSION

From the results of the effectiveness of phytoremediation by using water jasmine, lotus and vetiver in reducing phosphate levels in hospital wastewater, it can be concluded as follows:

1. Phosphat content before being given a treatment of 4.60 mg / l. These results are still above the quality standard according to the Central Java Provincial Regulation Number 5 of 2012 which is 2 mg / l.
2. There is a decrease in phosphat content in water jasmine plants weighing 200 g of 23.04%, weight of 400 grams of 16.40%, weight of 600 grams of 34.21%. Lotus plants 200 gr in the amount of 12.75%, weight of 400 g in the amount of 42.30%, weight of 600 gr in 57%. Vetiver root plants 200 gr by 24%, weight 400 gr by 14,64%, weight 600 gr by 14,99%.
3. The most effective decrease in phosphat content is found in lotus plants weighing 600 grams which is capable of reducing up to 57%, and decreasing it according to the required quality standards.

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