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The Ability of *Lemna minor* L. and *Pistia stratiotes* L. to survive in hospital waste

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Abstract.*Hospital waste can pollute the environment. Waste from a hospital in Bireuen was sampled in this study because it has a characteristic blackish cloudy color and strong odor. This study aims to see the ability of aquatic plants Lemna minor L. and Pistia stratiotes L. in hospital waste. This research was conducted using experimental methods. Result of this study indicate that the Lemna minor L. and Pistia stratiotes L. have different tolerances in hospital waste. Pistia stratiotes L. was able to adapt in high concentrations of waste, while Lemna minor L. was only able to survive at a low concentration of waste.*
Key Words*:Lemna minor, Pistia stratiotes, waste*

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I. Introduction

Every aquatic plant that has a habitat in a free environment has a high tolerance for physical factor of environmental.Hospital waste was produced by medical activities, the waste that disposed into the environment and is thought to pollute the environment.[1]*Lemna minor* L. can be used for waste treatment because of their high growth rate and ability to absorb nutrients directly. Various types of *lemna*sp. can be used in the processing of domestic and industrial waste in several countries reported the ability of *Lemna minor* L. to absorb NH4 and NO3 through its roots and leaves.

Pistia stratiotes L. is generally only known as a nuisance in lakes.[2] Plant roots are in the form of fiber roots, degraded in the upper layer of the watercourse and are very potential to absorb dissolved materials in the waters.[3] In addition, because *Pistia stratiotes*L.has a binding power for fine mud grains, it can be used to purify water for industry and daily needs. According to the Water Resources Research and Development Center (2008), the *Pistia stratiotes* L. can reduce N and P elements respectively, namely 25% and 12% per week with absorption of initial levels of 0.847 mg / 1 and 0.493 mg / 1 each week.

II. Materials and Methods

The research used experimental research method, the ability of the *Lemna minor* and *Pistia stratiotes* to the waste intheHospital Wastewater Treatment Plant with four levels. Waste resulting from the Hospital Wastewater Treatment Installation quickly or effectively for each treatment. The first treatment is given by wastewater from the waste water treatment plant with a volume of 2 liters with a level of 90%, 70%, 50%, 0% and control, each concentration has a difference of 20%.[4]The plants treated in this study were plants that had been adapted and were young plants, transferred to each container to cover the surface of the waste water in a 5 liter of water and 2 liter waste. This study measured the growth of the aquatic plant (*Lemna minor* L. and *Pistia*

[1]Suharto Ign, 2011, *Limbah Kimia Dalam Pencemaran Udara dan Air*, Yogyakarta: Andi Publisher.

[2] Cedergreen, N. and T. V. Madsen, 2002, "Nitrogen uptake by the floating macrophyte *Lemna minor", New Phytologist*, 155: 285–292.

[3] Mohd. Yusuf dan Baharuddin Hamzah, 2013 "Kandungan Merkuri (Hg) Dalam Air Laut, Sedimen, Dan Jaringan Ikan Belanak (*Liza Melinoptera*) Di Perairan Teluk Palu", *Jurnal Akad.* Kim. Vol. 2, No.3.

[4] Irhamni, Setiaty Pandia,Edison purba, Wirsal Hasan, 2018 "Analisis Limbah Tumbuhan Fitoremediasi (*Typha latifolia*, Eceng Gondok, KIambang) dalam Menyerap Logam Berat, *Serambi Engeneering*, Vol. III

stratiotes L.) by measuring the length of the plant leaves. Measurement of the leaf length is to determine the growth of the plants at the various concentrations levels of Hospital waste.

2.1 Research Steps

This preparatory stage begins with finding the problem, then determining the title and writing a research proposal until it is approved for research. Then prepare the tools and materials. The materials that need to be provided are the specified plants. The two types of plants, namely the *Lemna minor* L. and *Pistia stratiotes* L. were maintained in a tub in a green house provided with clean water media before being used as plants for treatment using hospital wastewater. The tillers of each species are maintained with the aim of adapting the plant before being used as a plant in research, and it is intended that the plant does not contain elements or compounds that may have been present in the previous habitat. The adaptation process of this plant lasts for three weeks, then the new tillers from the plant are separated from the plant before. Withdrawal of waste water is carried out by installing a pipe and a jerry can in the sewage tub. Ninety liters of waste are taken. Then separated 100 ml for the initial . The waste was diluted with various concentration levels as required in the study.

The core stage begins with taking the plants. The plants referred to are aquatic plants that have been adapted during the preparation stage. The two types of aquatic plants were then transferred to wastewater media in a container with a volume of five liters and given two liters of hospital wastewater with different concentrations. Measurement of the growth of the plants (cm) and measurement of physical factors such as pH and water temperature (° C) of the waste during treatment were measured daily. The growth of the ed plants was measured using ruler with an accuracy level of 0.1 mm.

III. Research Results

The ability of these plants to absorb elements in the treated hospital waste showed an effect on the growth of the two plants. Research that has been carried out in laboratory gardens with an average room temperature of 27℃ and an average temperature of wastewater in the treatment container is 26.2℃. The average value of the degree of acidity (pH) of wastewater for each treatment was 8.64 and control water had a pH of 9.24. The pH value has increased from before being treated at each concentration. The pH of wastewater before being treated with the two types ofplants had an average pH value of 7.42, namely in the neutral category. The graph of the growth of the plant 1 *Lemna minor* L. during treatment can be seen in Figure 1.2.

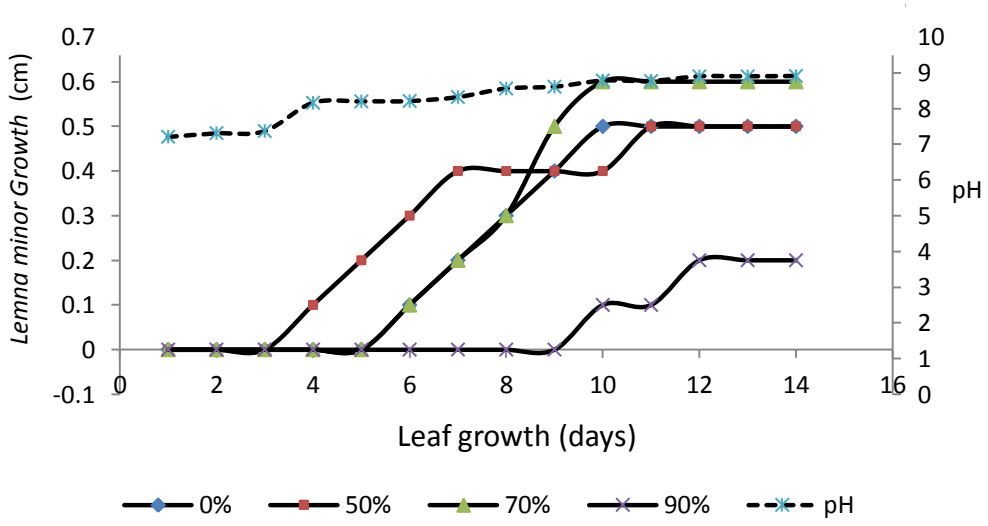

Figure 1.2 *Lemna minor* L. Leaf Growth at Various Levels of Waste Concentration

Lemna minor L. during the treatment experienced different growth conditions between one waste concentration level and another. *Lemna minor* L. has a low tolerance for treatment with a concentration of 90% and a concentration of 0% (control). *Lemna minor* L. was not able to survive or adapt to waste conditions with high concentrations and experienced decreased growth at the lowest concentration in the treatment(control). Waste with control treatment certainly has low mineral or nutrient salts for the needs of *Lemna minor* L. so that the plants in the control treatment lack the substances needed as nutrients for growth. The treatment with high concentrations contained higher nutrients or pollutants so that the *Lemna minor* L. plant was unable to adapt until it died.

*Pistia stratiotes*L. are able to survive and continue to grow at a concentration of 90%, even though at first the leaves turn yellow to rot, along with this incident new leaves also continue to grow to reach 5 to 8 cm in eight days. *Pistia stratiotes*L. in 0% treatment of Pistia leaf waste also experienced slow yellowing of the leaves. The two plants used in this study grew well on wastes with concentrations of 70% and 50%, these plants thrived with green leaves, and in wastes with a concentration of 70% slightly greener than in wastes with a concentration of 50%. The growth graph of *Pistia stratiotes* during treatment can be seen in Figure 1.3.

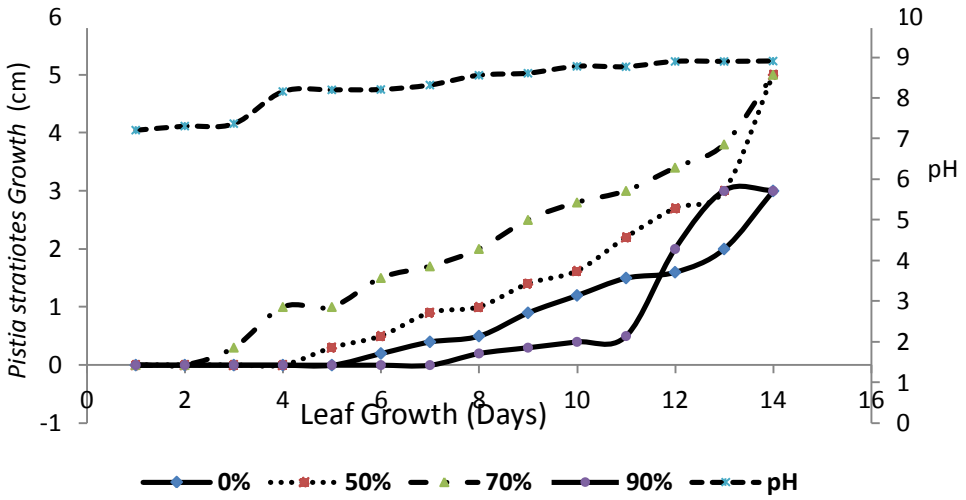

Figure 1.3 Growth of *Pistia stratiotes* L. Leaves at Various Levels of Waste oncentration

The comparison of the growth values of the two ed plants during treatment can be seen in Figure 1.4.

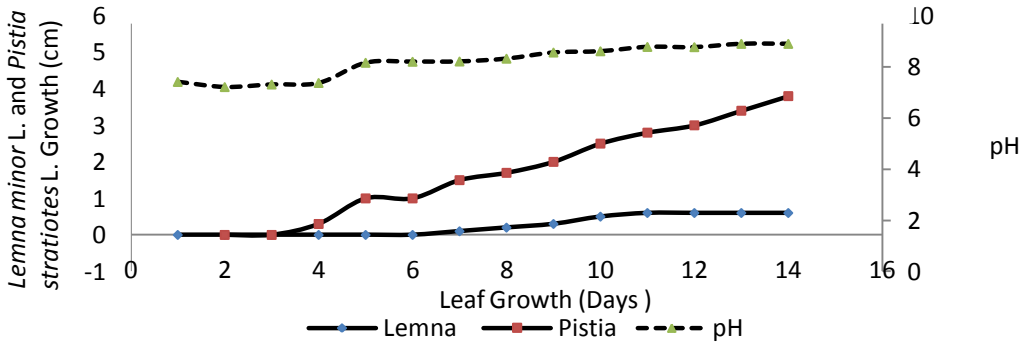

Figure 1.4 Comparison of Leaf Growth of *Pistia stratiotes* L. and *Lemna minor* L. in Wastewater Media (Condition: Concentration of Waste 70% at Room Temperature)

Figure 1.4 shows the comparison of the growth of *Pistia stratiotes* L. during the two weeks of treatment was faster than the growth of *Lemna minor* L. and the plants only experienced 0.4 cm leaf length growth for 14 days of treatment. Figure 1.4 shows that *Pistia stratiotes* L. can grow better than *Lemna minor* L. in wastewater treated for fourteen days.

The treatment with high concentrations contains higher nutrients or pollutants so that the *Lemna minor* L. has an excess of certain minerals so that it is unable to adapt until it dies.This principle is expressed as Shelfotd's law of tolerance, which reads "*every organism has an ecological minimum and maximum, which are the lower and upper limits of the organism's tolerance range to its environmental conditions.*"[5]*Pistia stratiotes* L. are able to survive and continue to grow at a concentration of 90%, even though at first the leaves turn yellow to rot, along with this situation new leaves also continue to grow to reach 5 to 8 cm in eight days. The changes that occur in the *Pistia stratiotes* L. are the adaptation of the plant to its environmental conditions or the response of the plant to the physical conditions of its environment, in accordance with the ecophysiological

[5]Dharmawan A.,2005, *Ekologi Hewan*, Malang: UM Press.

understanding, namely in general, the relationship between the physical functions of living things and their environment, or in this case how the *Pistia stratiotes* L. responds to or tolerates its environment .[6]

IV. Conclusion

Aquatic plants *Lemna minor* L. and *Pistia stratiotes* L. have bed tolerances to hospital wastewater or hight physical conditions of its environment. *Pistia stratiotes* L. was able to adapt to high concentrations of waste while *Lemna minor* L. was only able to survive at a waste concentration of 70%.*Pistia stratiote* L. has bigger size of leaves than *Lemna minor*L. The morfologi of plants influence how much the plants can survive in their environment.

V. Appendices

A. Results Documentation

Figure 2. Layout of Research Samples

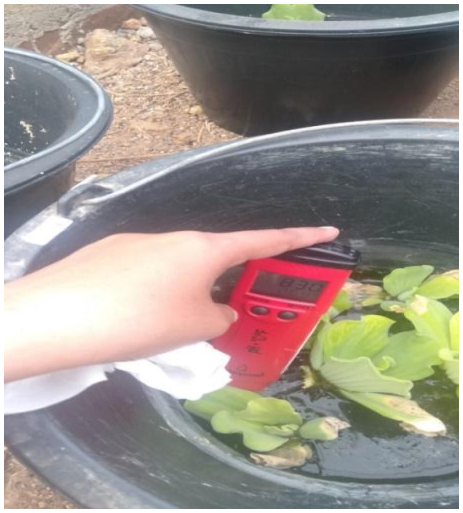

Figure 3. Data collection

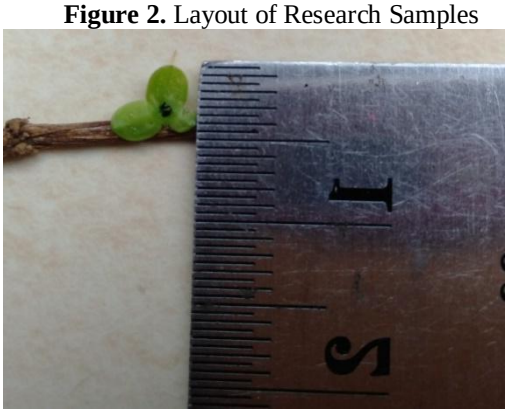

Figure 6.*Lemna minor* L.

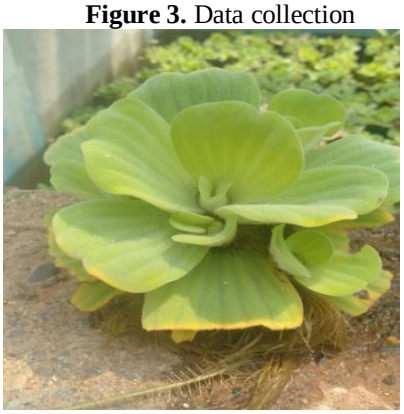

Figure 7. *Pistia stratiotes* L.

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