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# Pistia stratiotes and Limnocharis Flava as Phytoremediation Heavy Metals Lead and Cadmium in the Arbes Ambon

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## Abstract

The results showed that the river water contains heavy metals Arbes lead and cadmium. In addition to the found heavy metals, Arbes in river also found a few aquatic plants that are suspected to have the ability to accumulate heavy metals. After a laboratory test, it turns out both of these plants are used as potential agents of phytoremediation in accumulate lead and cadmium. *Pistia stratiotes* is able to accumulate lead as much as 16,683 ppm (75,832%), cadmium as 11,585 ppm (77,233%) for 4 weeks and *Limnocharis flava* accumulate lead as much as 13,799 ppm (62,723%), cadmium as 12,858 ppm (85,720%) for 4 weeks. *Pistia stratiotes* and *Limnocharis flava* is very potential as agents of phytoremediation because it can accumulate lead and cadmium in large and a short time.

*Keywords:* phytoremediation; heavy metal; arbes.

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## 1. Introduction

Arbes is one of the rivers that have significance for the people of Ambon since it serves as a raw drinking water source [1]. Around the many wild plants growing Arbes adapted his life with water conditions and potential enough for local people because there are several wild plant species are used as food ingredients and are mostly used as raw material of liquid organic fertilizer. Water plants in question are *Pistia, Lotus,* and *Limnocharis* where a third of the crop is flowering plants that have fully adapted to life on the surface of the water [1,2].

Many of the activities undertaken by the society that caused the decline in the quality of the Arbes, like: using the a domestic waste disposal, as a place to wash, and other waste disposal as a potential lead to the influx of heavy metal impurities and other impurities into the river. Heavy metals are natural components of the environment that needs to get more attention from the public and the government due to the accumulative nature so that the impact caused to marine ecosystems as well as human beings is very dangerous [1-4].

The term heavy metal is metal that has pointed at specific gravity higher than 5 or 6 $g/cm^3$, but in fact in the sense of these heavy metals, included also the metalloids elements have such harmful properties: As, Cd, Cr, Cu, Hg, Ni, Pb, and Zn. Lately the dangers posed by heavy metals is a very prominent environmental issues. Various hazardous waste currently generated by human activities, and poses a problem in handling. This is because the form of the various waste and has diverse levels anyway. Form of solid waste gives rise to relatively local influence, but in the form of waste-liquid waste or yawns can influence more broadly, and more difficult prevented to contaminations [5-7].

Nature basically has a mechanism to reduce the negative effects of the buildup of heavy metals on ecosystems, however often happens the buildup of heavy metals that exceed the ability of nature to process it. It can cause hazard consecutively, given the interdependencies between the components of ecosystems in nature [6]. Heavy metals known to accumulate in the body of an organism, and remain in a prolonged period of time, as poison. The event was widely publicized and stand out due to heavy metal contamination is pollution of mercury (Hg) which causes minamata bay in Japan minamata desease and pollution of cadmium (Cd) which caused the itai-itai disease and cancer of the liver Jinzo river on the island of Honsyu Japan.

Given the importance of the role of the Arbes for society, then it is must be to do a study on the analysis of the levels of heavy metals lead and cadmium especially on aquatic plants (*Pistia* and *Limnocharis*) so that the retrieved information related capabilities in both of these plants accumulate heavy metals and can serve as one of the agents of phytoremediation are cheap and potent in addressing waste heavy metals into the river. As for the problem to be formulated in this research are: 1. How do quality Arbes river water in terms of heavy metal impurities of lead and cadmium? 2. How does the ability of *Pistia stratiotes* and *Limnocharis flava* in accumulate heavy metals lead and cadmium?

## 2. Material and Methods

This type of research this type of research is the laboratory experiments that aim to find out the quality river Arbes reviewed heavy metal impurities of lead and cadmium, and ability *Pistia stratiotes* and *Limnocharis flava*

in accumulate heavy metals lead and cadmium. Design used was the one shoot design that taking samples of water in 4 point in river Arbes (the middle part of the river) and then mixed into one (homogeny), taken by as much as 1 L for testing the levels of heavy metals lead and cadmium. Laboratory experiments were conducted to determine the ability of *Pistia stratiotes* and *Limnocharis flava* as phytoremediation agents [8].

The object of this research study is the ability of *Pistia stratiotes* and *Limnocharis flava* in accumulate lead and cadmium which comes from river Arbes. This research plan was implemented for 1 month which was preceded by the observation location research and continued with the research laboratory for river quality data capture Arbes reviewed heavy metal impurities of lead and cadmium, and phytoremediation in the agent's ability to accumulate lead and cadmium. Tools and materials used in this research are: sampling bottle water, hot plate, measure out the flask, pipette drops, beaker, and atomic absorption photometry spektro. As for the materials used in this research are: aquadest, $HNO_3$, $PbHNO_3$, and $CdSO_4$ 8 $H_2O$.

Observations to observe and analyze the condition of the area of research covers the activities of the community in utilizing the river for washing, bathing, and drinking. Every water with point sampling done in a grab sample (instantaneous shooting) and taken 4 sample duplicate field (field duplicate sample) as independent sample as much as 2 samples and water samples are then taken to a lab for analysis. Testing agent phytoremediation provides: a test prior treatment plants to aclimatisation for 2 weeks in laboratory conditions. Provides 3 containers filled with water each 1 L have acording levels of heavy metals lead and cadmium. Put the plant into a container (each container contains 200 grams of plant). Every one week conducted measurements of the levels of heavy metals remaining in the sample water. Measurements made over 4 weeks [8,9].

Data quality of river water and the ability of the agent phytoremediation Arbes in accumulate heavy metals lead and cadmium is obtained from the results of laboratory testing. Community activity data that affects the quality of the river Arbes obtained through questionnaires and interviews. Data analysis is sorcery, or the search for meaning from data obtained to find answers to the problem of research. Data analysis tailored to the research objectives to be achieved. Data analysis conducted included analysis of river quality, the ability of the agent phytoremediation Arbes in accumulate lead and cadmium and activity analysis society

## 3. Result and Discussion

### 3.1. Community activities that cause pollution

Data about the activity of the society which led to water pollution in the Arbes Ambon obtained through now are charging results by respondent, namely 10 people: 5 respondents who settled around the upper reaches of the river and 5 respondents who lived around the body (middle) river. General activity of the society is conducted by washing, bathing, agriculture, dump plastic or glass in to river, and drains the stool through the pipeline. For more details can be seen in table 1 below.

Table 1 above shows that there are many community activities which is the cause of the contamination of river Arbes. Most of the activities carried out by the community who contributed most of the pollution is washing, bathing, recreation, and the stool that comes directly or flowing from the homes of residents who don't have

septic tanks.

**Table 1:** That causes pollution of the activity

| No | Questions indicator | Frequence | | Percentage (100%) | |
|----|---------------------|-----------|-----|-----|-----|
| | | Yes | No | Yes | No |
| 1 | Use for bathing. | 10 | 0 | 100 | 0 |
| 2 | Use to wash clothes. | 10 | 0 | 100 | 0 |
| 3 | Dispose of bottles, cans, glass into the river. | 6 | 4 | 60 | 40 |
| 4 | Shitting into a river. | 4 | 6 | 40 | 60 |
| 5 | Tillage around the river. | 5 | 5 | 50 | 50 |
| 6 | Place of rekresiasi. | 10 | 0 | 100 | 0 |
| 7 | Have the septic tanks. | 6 | 4 | 60 | 40 |
| 8 | Dispose of used oil | 3 | 7 | 30 | 70 |

### 3.2. A heavy metal Levels of lead and Cadmium in Arbes river

Water test results for heavy metal levels of water taken in the Arbes purposive sampling on a 4 point indicates that the levels of lead and cadmium are still at reasonable limits with the data presented in table 2 below

**Table 2:** Results of the levels lead and cadmium in river Arbes

| Sampling point | content Pb (ppm) | content Cd (ppm) |
|----------------|------------------|------------------|
| 1 | 2,2320 | 1,6141 |
| 2 | 2,3742 | 1,5478 |
| 3 | 2,5453 | 1,6732 |
| 4 | 2,6498 | 1,7263 |
| Rerata | 2,4504 | 1,6404 |

Table 2 above shows that the water contains lead and cadmium with different levels. The average content of lead and cadmium is 2,4504 ppm and 1,6404 ppm. Heavy metal is thought to derive from the activity of society who lived around the river Arbes that often get rid of waste into the river such as: domestic bottles, plastic, cans, glass, used oil, water marks and domestic waste more

### 3.3. Pistia stratiotes and Limnocharis flava in Accumulate heavy metals lead and Cadmium

*Pistia stratiotes* and *Limnocharis flava* in accumulate lead do not differ greatly. For more details can be seen in

table 3 below

**Table 3:** Pistia stratiotes and Limnocharis flava in accumulate heavy metals lead

| Species of plant | Pb levels early (ppm) | The ability to acumulate……Weeks to- | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| *Pistia stratiotes* | 22,000 | 15, 901 | 9,901 | 7,920 | 5,317 |
| *Limnocharis flava* | 22,000 | 17, 205 | 12,347 | 9,101 | 8,201 |

Table 3 above shows that the ability of accumulation of the lead to the two plants is very high, this can be seen from the rest of the heavy metals in the media try after week four was 5,317 ppm (for *P. stratiotes*) and 8,201 ppm (for *L. flava*). *Pistia stratiotes* is able to accumulate lead as much as 16,683 ppm (75,832%) and *Limnocharis flava* accumulate lead as much as 13,799 ppm (62,723%) for 4 weeks exposure in the laboratory scale. In addition to making every effort in the second lead, accumulate such plants have the ability to accumulate cadmium. Data *Pistia stratiotes* and *Limnocharis flava* in accumulate cadmium can be seen in table 4 below

**Table 4:** Pistia stratiotes and Limnocharis flava in accumulate cadmium

| Species of plant | Cd levels early (ppm) | The ability to acumulate……Weeks to- | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| *Pistia stratiotes* | 15,000 | 8,211 | 6,720 | 5,029 | 3,415 |
| *Limnocharis flava* | 15,000 | 9,101 | 5,243 | 4,314 | 2,142 |

Table 4 above shows that the accumulation cadmium for these two plants is very high, this can be seen from the rest of the heavy metals in the media try after week four was 3,145 ppm (for *P. stratiotes*) and 2,142 ppm (for *L. flava*). *Pistia stratiotes* is able to accumulate heavy metals cadmium as 11,585 ppm (77,233%) and *Limnocharis flava* accumulate cadmium as 12,858 ppm (85,720%) for 4 weeks. *Pistia stratiotes* and *Limnocharis flava* is very potential as agents of phytoremediation because it can accumulate lead and cadmium in large and a short time

Lead and cadmium is a heavy metal which is highly toxic to humans because it can damage the nervous system and even cause death. Lead and cadmium can come from household waste, used oil, water, corrosive materials battery made of lead or cadmium and other sources. Research on lead and cadmium are already very much, however, for in the Arbes has never done. Arbes is the river that much utilized by communities to bath and as a source of raw us drink. The activities carried out by the people who lived around the river Arbes, resulting in the potential for river water polluted by domestic waste heavy metal impurities such as lead and cadmium [1,9].

The test results of water samples taken in the purposive sampling, indicate that the river contains lead and cadmium. Heavy metal is thought to derive from the domestic waste dumped directly into the river. The usual household waste found in the Arbes is plastic, cans, bottles, used oil, detergents, etc. Although the levels of heavy metals is still little, but calculated the amount will increase if not be solved early on. One of the efforts made by the researchers is to do a search for a biological agent could overcome pollutions heavy metals, such as using aquatic plants that can grow in polluted environments [1]. *Pistia stratiotes* and *Limnocharis flava* are two herbs that have the ability to grow in polluted environments, this is proven by laboratory studies that researchers are doing with these two plants grow on contaminated media lead and cadmium in large numbers. In addition, this plant can grow has the ability to accumulate heavy metals lead and cadmium in large enough amounts. With the exposure for 4 weeks, seen that from each week's observations indicated that the heavy metals in the plant is reduced and the media grow well. According to Cai that *Pistia stratiotes* has the ability to grow rapidly on the ecological conditions plagued by impurities. In addition both of these plants have the *phytochelatins* and *lothioneins* that can bind heavy metals and reducing the impact of toxic for the environment [10]. *Pistia stratiotes* and *Limnocharis flava* is a water plant which has a lot of rooting and type size, relative length so it has the ability to absorb large amounts of dissolved compounds because. Both plants can serve as one of the solutions to cope with the heavy metal impurities of lead and cadmium, especially in advanced research and Arbes will be undertaken by researchers is to detect the type of other heavy metals, chemical and microbiological test river water Arbes and designing an architecture application water plants as phytoremediation agents, such as creating a floating raft made from plastic waste or using newfangled vertical or horizontal bamboo so that all people can make and use the results of the draft because it's cheaper and the ingredients are easy to obtain [2,6,10].

## 4. Conclusions

**4.1. *The activity of the society who lived on nearby Arbes river flow which causes decrease in water is quality,*** washing, bathing, waste plastic, glass, cans, shitting, opening of the lading, absence of septic tanks, the river was used as a place for recreation, and the disposal of used oil in to river.

**4.2. *Pistia stratiotes and Limnocharis flava verry potential as an agent phytoremediation in heavy metals lead and cadmium.***

## Acknowledgements

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