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Response Growth and the Effectiveness of the Absorption of Heavy Metal B-Iii by Limnochris Flava on a Scale Laboratory

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Abstract : Waste is the remaining resulting from a process or events of industry and domestic. Many waste enter the pollution caused, destructive habitats, and reduce aesthetic. One of the ways easier and cheaper to reduce the impact was using *Limnocharis flava* as a phytoremediation. The result showed that *Limnocharis flava* can grow fine at environmental conditions that tainted and have the ability in absorb heavy metals lead (Pb), cadmium (Cd), and mercury (Hg).
Keywords : *Limnocharis flava*, heavy metal.

1. Introduction

Water is natural resources needed to public life and even by all living things. The need for the availability of a source of clean water for human being is essential needs to be fulfilled[1,21-44]. On the water pollution river can cause a decrease in on the quality of water. Efforts to maintain function water so its quality fixed on the natural condition so method processing can be doing by means of physics, chemical, and biological. Of three methods the number is the most efficient in lowering substance organic matter in waste water at a cost of relatively cheap is with the methods processing biological[2,17]. Pb, Cd, and Hg is in waters good naturally or as a result of human activity. Metal into waters through efflorescence in the air with water assistance rain or in with the waste industry or from household. Pb, Cd , and Hg could be in the body of waters in the 0,002 - 0,010 ppm[3]. Maximum levels of Pb on waters bounded by world health organization is less than 0.01 until 0.05 ppm[4]. Based on the resolution of state minister environment No. 82/2001 on guidelines the determination of water quality status, of quality standard Pb in water is 0,03 ppm while for Cd and Hg is 0.05 ppm[5]. According to Maharani, a compound or ions heavy metal in to the waters, has resulted in the an increase in the concentration, so as to Pb to death to an organism which is in waters. That environmental pollution does not occur, then required management safely and right namely by biological processes or using plants as agent phytoremediation[6,16].

Phytoremediation is using plants to remove, move, stabilize or destroy the contaminant whether it is organic compounds and inorganic compound[7]. A decrease in the concentration pollutants by the use of the activity of a plant known phytoremediation with the term[8]. One of the plants potentially absorbent (accumulator) metals the polluter is a plant *Limnocharis flava*. *Limnocharis flava* identified as herbs accumulator is against some heavy metals. According to Isaac, *Limnocharis flava* ability that can grow on polluted environment, with a pattern of special adaptations so as to be able to survive at the environment which contain elements of toxic or heavy metals. *Limnocharis flava* is a plant that theoretically can absorb water and metal so that it can be used as remidiator in the absorption of heavy metals. Research results indicate that Isaac, *Limnocharis flava* is able to absorb metal iron 20.32% - 63.99% and metal manganese 20.45% - 63.21%[9]. The

research results show that *Limnocharis flava* capable of in effective to reduce bod levels, COD, DO, TSS, sulphate, and phosphate in waters of tainted by waste[10]. This plant can grow with fertile on swampy areas either contaminated or not, besides reproduction being very quick often become a weed in paddy fields. His ability that can grow on polluted environment, with a pattern of special adaptations so that it could survive on the environment which contain elements or a toxic heavy metal

2. Material and Methods

The kind of research this is descriptive with the approach experiment laboratory aimed at to analyze response growth and the ability *Limnocharis flava* in accumulating heavy metals Pb, cd, and Hg on a scale laboratory. This study was conducted for about two months in the laboratory science IAIN Ambon and laboratory chemical UMM Malang. Material used in this research was *Limnocharis flava*, $PbNO_3$, $HgNO_3$, $CdSO_4$, whatman 42, HCl, and ethanol. An instrument used is aquarium, AAS, and steriform. Procedure work in this research was fill aquarium with water waste containing Pb, Cd, and Hg as many as 5 l; take measurements of the Pb, Cd, and Hg on the waste obtained from the river Arbes; conduct measurement of the height, length roots, and number of leaves *Limnocharis flava* before place plants in aquarium for 4 week; and take measurements of tall plant, long roots, number of leaves, konsetration Pb, Cd, and Hg at the end of observation[10,20].

3. Result and Discussion

3.1. Absorption Pb, Cd, and Hg by *Limnocharis flava*

Limnocharis flava preserved in in aquarium containing Pb, Cd, and Hg demonstrating ability in absorbing those heavy metal. Data absorption heavy metal Pb, Cd, and Hg by plants can be seen in table 1

Table 1 .*Limnocharis flava* ability to reduce heavy metals Pb

Aquarium code	Levels of Pb early (ppm)	The rest of Pb after the fourth week (ppm)	Pb accumulates (ppm)	The percentage Decreases Pb (%)
1	0,1145	0,0219	0,0926	80,873
2	0,1145	0,0177	0,0968	84,541
3	0,1145	0,012	0,1025	89,519
Average	0,1145	0,0172	0,0973	84,978

Table 1 shows that *Limnocharis flava* have the ability in sent down the heavy metal Pb successive: 0,0926 ppm, 0,0968 ppm, and 0,1025 ppm the average value of the decrease is 0,0973 ppm. The ability *Limcocharis flava* in lowering the heavy metal Pb is 0,0926 ppm - 0,1025 ppm or 80,873 % - 89,519 %.Data the ability *Limcocharis flava* in absorbing cadmium can be seen in table 2

Table 2. *Limnocharis flava* ability to reduce heavy metals Cd

Aquarium code	Levels of Cd early (ppm)	The rest of Cd after the fourth week (ppm)	Cd accumulates (ppm)	The percentage Decreases Cd (%)
1	0,116	0,0539	0,0621	53,534
2	0,116	0,04125	0,07475	64,439
3	0,116	0,03165	0,08435	72,715
Average	0,116	0,0422	0,0737	63,56

Table 2 shows that *Limnocharis flava* have the ability in sent down the heavy metal Cd successive: 0,0621 ppm; 0,07475 ppm, and 0,08435 ppm the average value of the decrease is 0,0737 ppm. The ability

Limcocharis flava in lowering the heavy metal Cd is 0,0621 ppm – 0,08435 ppm or 53,534 - 72,715%. Data the ability *Limcocharis flava* in absorbing mercury can be seen in table 3

Tabel 3. *Limnocharis flava* ability to reduce heavy metals Hg

Aquarium code	Levels of Hg early (ppm)	The rest of Hg after the fourth week (ppm)	Hg accumulates (ppm)	The percentage Decreases Hg (%)
1	0.007	0.0022	0.0048	68.571
2	0.007	0.00185	0.00515	73.571
3	0.007	0.00135	0.00565	80.714
Average	0.007	0.0018	0.0052	74.285

Table 3 shows that *Limnocharis flava* have the ability in sent down the heavy metal Hg successive: 0,0048 ppm; 0,00515 ppm, and 0,00565 ppm the average value of the decrease is 0,0052 ppm. The ability *Limcocharis flava* in lowering the heavy metal Hg is 0,0048 ppm – 0,00565 ppm or 68.571% - 80.714%.

3.2. Limnocharis flava Growth

Limnocharis flava experienced growth is a good enough on environmental conditions that tainted. Data addition tall plant can be seen in table 4

Table 4 Height Limnocharis flava

Aquarium code	Average height early (cm)	The average height of the end (cm)	The ratio of the addition of another height (cm)
1	55.62	64.37	8.75
2	55.57	62.15	6.58
3	55.12	55.92	0.8
Average	55.43	60.81	5.37

Table 4 shows that *Limnocharis flava* experienced in high successive 8.75 cm; 6,58 cm; and 0.8 cm with an average addition were high 5,37 cm .Long roots in *Limnocharis flava* can be seen in table 5

Table 5 length of the root *Limnocharis flava*

Aquarium code	The average length of roots early (cm)	The average length of the root of the end (cm)	The ratio of the addition of another length roots (cm)
1.	19.75	25.45	5.7
2.	21.25	23.95	2.7
3.	23.45	23.58	0.13
Average	21.48	24.32	2.83

Table 5 showed that *Limnocharis flava* experienced long roots in successive 5.7 centimeters; 2.7 centimeters; and 0.13 cm with an average addition long is 2,83 cm. Data the growing number of leaves *Limnocharis flava* can be seen in table 6

Tabel 6. Number of leaves *Limnocharis flava*

Aquarium code	The average number of leaves early	The average number of leaves of the end	The ratio of the addition of another number of leaves
1.	1.75	3.75	2
2.	3.5	4	0.5
3.	2.75	3.25	0.5
Average	2.67	3.67	1.67

Table 6 showed *Limnocharis flava* experienced increase the number of single leaves after four are in aquarium containing heavy metal Pb, Cd , and Hg. The growing number of leaves the plant successive 2; 0.5; and 0.5 with an average increase the number of single leaves is 1.67

Based on the results of research indicates that *Limnocharis flava* has the potential that is very significant in improving the quality of water, especially in reducing levels of heavy metals. Herbs having *Limnocharis flava* type rooting long so that serves as the compound heavy metal. Heavy metal attached to roots may occur because of a chemical compound in the form of a protein called fitokelatin and fitokelanin who can react with metal ions form complex chelate metal. Proteins are able to bind to heavy metal because it has a cluster of sulfidril. Absorption and the heavy metal by plants can be divided into three the process of sustainable, namely the absorption of metal by the roots, translokasi metal from the root to the another plants, and localization metal on the certain cells to keep so they do not hinder metabolism the plant. The absorption by roots done with metal into a solution around roots of (rizosfer) with several a manner dependent on species plants. After metal brought went into the cell roots, next metal to be translokation in the organ herbs through the tissue for transporting, namely xylem and phloem, to the another plants. To improve the efficiency transportation, metal fastened by molecular chelate[7,16]. Heavy metal that is in a land environment, water and air with a certain mechanism enter into the living body. Plants that being a mediator the spread of heavy metals in living things, absorb heavy metal through roots and leaves (stoma). Heavy metal been absorbed into the tissues of plants through roots, which will then enter into the food chain unfolding. Heavy metal absorbed by the roots of plant in the form of ions soluble in water as organic element who participate in with the flow of water. The environment that many contain heavy metals make proteins regulator in of the plant forming compound fastener called phytochelatin. Phytochelatin is a peptide containing 2-8 amino acid of cysteine in central molecule as well as a glutamic acid and a glisin on opposite ends.

Phytochelatin formed in nucleus that then passing reticulum endoplasmic (RE), apparatus golgi, vasikula secretori to get to the surface of cells[11]. Heavy metal can enter in the cells and bonded with enzymes as catalyst, so that a chemical reaction in the cells of plants will be disrupted. Disorder can occur in the epidermal tissue, sponsa and a palisade. The damage can be marked with necrosis and plants from chlorosis on herbs. Accumulation of metal by *Limnocharis flava* lasting through roots and will be distributed throughout their organs until into a leaf[7]. In roots, regular crops change ph then forming a substance chelate called fitosiderofor. This element then chelate metals brought into the roots. To increase the metal, so this plant form molecules reductase in the membranes roots. The heavy metal large on *Limnocharis flava* supported by the roots example of those who spend having a relatively great size and long, leaves thin and wide and structure its furnished with spons the water

Vital processes in phytoremediation is rhizofiltration. Rhizofiltration is the deposition of a substance contaminants as heavy metal by the roots with the help of substance chelat[12]. This is in line with the opinions Heriyanto, they have a certain mechanism to prevent metal poisoning to cell one of them by heaping metal in certain organs as roots[13,19]. The effort to prevent metal poisoning against the cells and tissues, plants have detoxification mechanism, for example by heaping metal in certain organs as roots. The accumulation of metal was a localization done by plants, collected in one organ. In the past of metal plasmalemma, cytoplasm, and vacuoles, where metals to localisation or accumulated in vakuoles[14]. Vacuoles keep metal do not hinder metabolism plants. So no metal would be related to physiology processes cells plants. According to Heriyanto on the network roots, metal in the cortex and acumulation near endodermis. Endodermis serves as partial barrier to transfer of metal from the root. This is one reason of the accumulation of metal greater roots[13,16].

Plants of the when absorb heavy metal, will form an enzyme reductase in the membranes its roots. Reductase it serves reduce metal next transported through of a special mechanism in in a membrane roots. In the event of translokation in the organ herbs, metal went into the cell roots, next transported to the herbs another through the tissue for transporting namely xylem and floem. To improve the efficiency transportation metal fastened by molecular a chelate. In low concentration heavy metal not influenced the growth herbs but in high concentration will cause destruction of both on the ground, water and herbs with limited factors this research still showing any chance the ability absorption Pb by plants water until the minimum limits[15,20]. The ability absorption heavy metal Cd by *Limnocharis flava*, followed its ability to an easy life , having breeding generative a very fast and able to stay alive at environmental conditions tainted, this is shown to a growth that good enough which includes addition high, long roots, and the number of the leaves at the end after exposure by waste for fourth week. Based on parameter growth observed it can be seen that *Limnocharis flava*, have the ability growing is a good enough on environmental conditions that tainted. The ability the plant multiplied and grow in the waters tainted made the plant this could used as a potential phytoremediation in overcoming heavy metal, especially lead, cadmium, and mercury

4. Conclusion

Limnocharis flava have the ability in absorb heavy metals lead, cadmium, and mercury and *Limnocharis flava* have the ability to grow good enough on the environment that contains heavy

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