Original Research Article

VARIATION OF MINERAL AND HEAVY METAL CONTENT IN LEMNA CULTURE FERTILIZED BY BIOSLURRY

ABSTRACT

Lemna minor is a small water plant that floats on water and has the potential to be fresh feed for fish. Bioslurry is a by-product of the management of biogas from livestock manure which is often used as fertilizer for plants. This study aims to determine the mineral (Mn) and heavy metal (Pb) content in the medium of lemna cultivation which is fertilized with various doses of bioslurry. The study was conducted at the Ciparanje Experimental Pond, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. This study used an experimental method with Completely Randomized Design (CRD) with four treatments with three replications. The treatment in the form of adding bioslurry to the lemna culture media was 0.00%, 0.25%, 1.00%, and 2.50% of the volume of water. The minor density of Lemna used is 800 g / m2. The culture was carried out in 4 cycles for 6 days. The parameters observed were Mn and Pb content in the lemna culture medium shortly after the addition of Bioslurry and after 6 days of lemna cultivation. Based on the results of the study, the use of 2.5% bioslurry concentration can produce the highest Mn content with a range of 2.0-4.6 ppm and 2.92 ppm Pb content after 6 days of lemna cultivation. In addition, the use of 2.5% bioslurry concentration resulted in Mn and Pb values in the culture medium shortly after stirring bioslurry in the lemna culture media.

Key words : bioslurry, culture, Lemna minor, Mn, Pb

INTRODUCTION

One of the main obstacles faced by traditional fish farmers is expensive price of feed which causes high production costs in fish farming activities. Providing good quality feed can be a challenge for traditional fish farmers because of price of conventional feed is expensive. Thus, alternative feed ingredients must continue to be developed. One of the feed ingredients that can be explored is duckweed, which has been dominating the waters in Indonesia and has not been used optimally as an ingredient in feed (Hazrah, 2017).

Lemna (Duckweed) is a small-sized aquatic plant that floats on water and has the potential to be a fresh feed or feed ingredient because it has a high nutrient content (Landesman et al. 2005). The potential use of local raw materials that can substitute fish nutrition ingredients is a strategic step to deal with the high conditions of feed raw materials such as fish meal. Efforts to develop *L. minor* culture as a feed can be done by using organic fertilizer, one of which is bioslurry. Bioslurry is a by-product of biogas processing. Bioslurry has the potential to be used as fertilizer because it has nutrients that are needed for plant growth (Lamprey et al 2004).

Pb (Heavy Metal) is one of the most harmful ions in the environment and is considered a heavy metal that can be seriously endanger the environment. This metal is very toxic and very dangerous, according to the US Environmental Protection Agency the maximum contaminant level for Pb^{2+} in the minimum water is 0.015 mg / L. Minerals are inorganic materials needed by fish for the formation of body tissues, metabolic processes and maintaining osmotic balance and for the normal growth process of fish. The amount of minerals needed by fish is very small but has a very important function. In the preparation of artificial mineral mix feed, usually minerals are added in the range of 2-5% of the total amount of raw material and varies depending on the type of fish that will consume it (Gusrina, 2008). This study aims to determine the mineral content (Mn) and heavy metals (Pb) in the cultivation of lemna fertilized with various doses of bioslurry, so that it will be known bioslurry treatments that provide the highest mineral content and low Pb absorption.

MATERIALS AND METHOD

The research was conducted from March 16 to April 5, 2016 at the Ciparanje Experiment Pool, Faculty of Fisheries and Marine Sciences. Proximate analysis of bioslurry and *Lemna minor* was conducted at the Nutrition Laboratory of the Faculty of Animal Husbandry, Padjadjaran University. The instrument used during the study were 15 plastic containers (68x48x40 cm3) to be used as a container for L. Minor culture, gauze to help the process of water drainage from *L. minor*, and scales with an accuracy of 0.1 g to calculate the weight of *L. minor*. pH meter of brand Ultron PH-207 was used to measure the pH of water, thermometers, and beaker glass were used to place and measure the temperature of the water sample.

The materials used in this study are as follows: *L. minor* water plants used came from Ciparanje hatchery ponds, Universitas Padjadjaran. Bioslurry was used as a source of nutrition for L. minor growth. The used bioslurry came from the Batu Lonceng Complex, Lembang, West Java. The water media used comes from the Manglayang mountain spring.

This study used an experimental method with a Completely Randomized Design (CRD) model consisting of 4 treatments and 3 replications. The treatment used was bioslurry added to culture media with a percentage of A = 0.00% (control), B = 0.25%, C = 1.00%, D = 2.50%. The parameters observed in this study were testing the content of Mn and Pb in lemna culture media shortly after the addition of Bioslurry and after 6 days of lemna cultivation. Measurement of Pb and Mn content using AAS (Atomic Absorption Spectrophotometry) method. The results of observations of the proximate test regarding the Pb and Mn content were analyzed descriptively.

RESULT AND DISCUSSIONS

Mn and Pb Content in Bioslurry in Lemna Cultivation Media

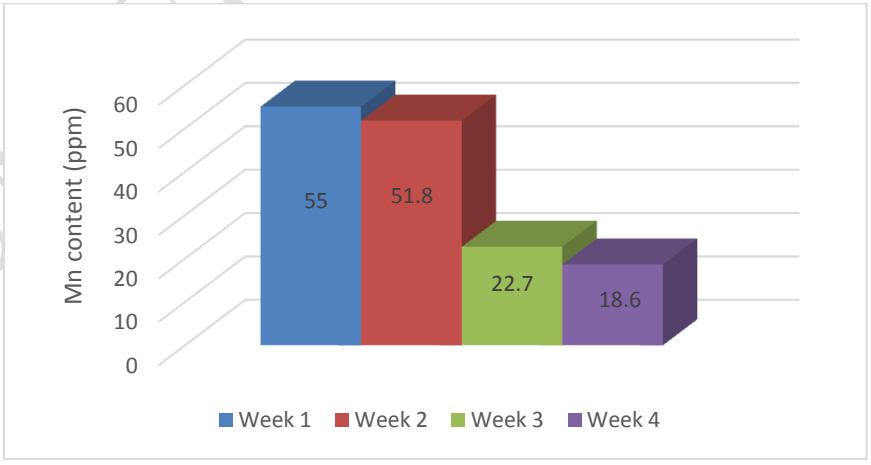
Based on the results of the research, the content of Mn and Pb in lemna cultivation media fluctuates on a weekly basis. The Mn content in the lemna culture media ranged

between 18.6-55 ppm while the Pb content in the lemna culture media ranged from 0.1-4.29 ppm. Based on observations it can be seen that the Mn content in lemna culture media has decreased from the first week to the fourth week. The same thing happened in the observation of Pb content during the study with an increase in Pd value in the beginning of the research and then decreased until the last week. This shows that there is absorption of Pb and Mn carried out by lemna.

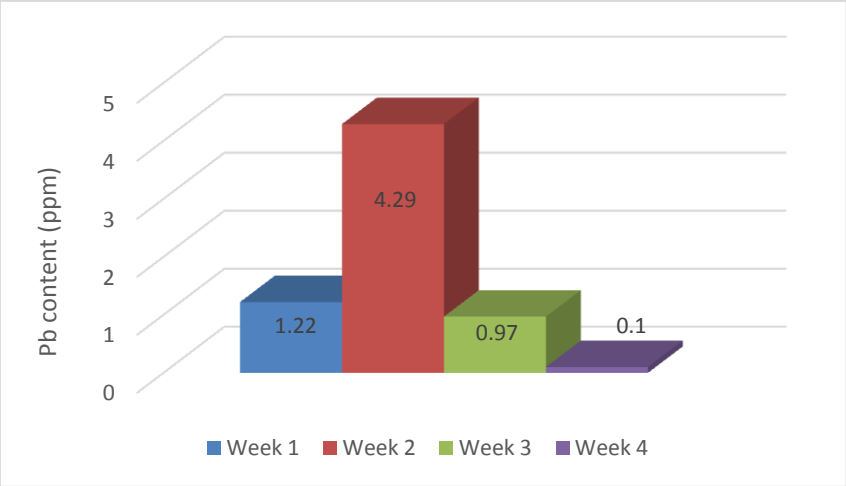
The mineral element is one of the most indispensable components for fish besides carbohydrates, fats, proteins and vitamins. Various mineral elements found in biological material, but not all minerals are proven essential, so there are essential and nonessential minerals. Essential minerals are minerals that are needed in the physiological processes of living things to help the work of enzymes or organ formation. Other mineral elements such as iron, iodine, copper and zinc are present in small amounts in the body, because it is called trace element or micro minerals (Aisyah, 2012)

The benefits or functions of minerals for fish are as main constituents of skeletal structures such as bones, heads, teeth and scales, for electron and cofactor (activating) transfers in metabolism, catalysts and activator enzymes, as regulation of acid-base balance and osmoregulation systems of blood or body fluids others, as well as important components of vitamins, hormones, enzymes and respiratory pigments (Susanto and Fami 2012).

PB is a category of heavy metals that are not essential or toxic to the body of living thing. Heavy metal pollution can cause changes in the structure of aquatic ecosystems, food webs, behavior, physiological, genetic and resistance effects. In contrast to ordinary metals, heavy metals usually have dangerous effects on living things. Heavy metals can be toxic substances that will poison the bodies of living things (Palar, 1994). Heavy metals in water are easily absorbed and buried in phytoplankton which is the starting point of the food chain, then through the food chain to other organisms (Fardiaz, 1992). The following is a graph of the Mn and Pb content in the lemna culture media on a weekly basis (Pictures 1 and 2).



Picture 1. The content of Mn in Lemna Cultivation Media on Every Week

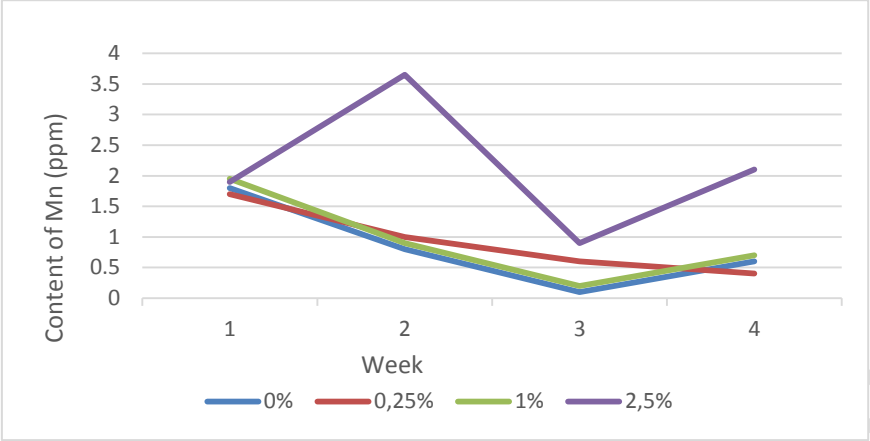


Picture 2. Pb content in Lemna cultivation media every week

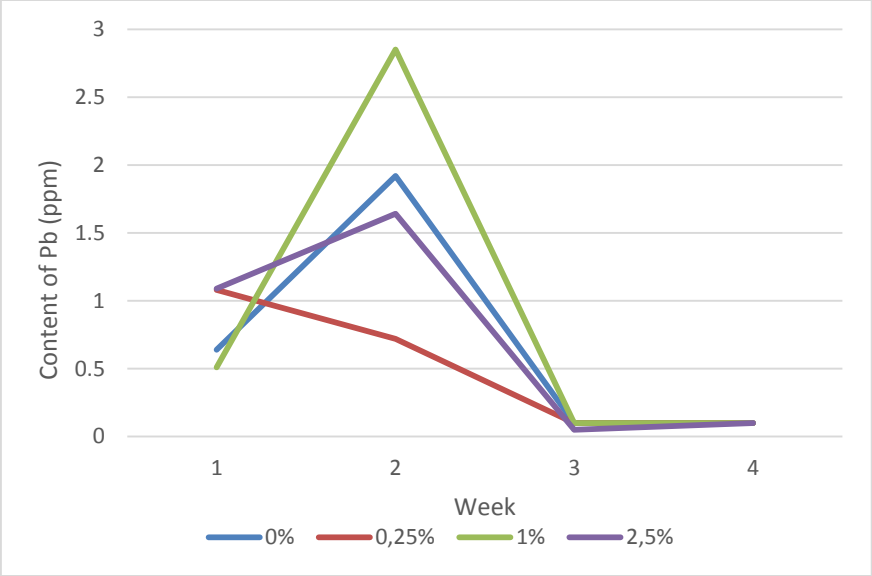
Mn and Pb Content Shortly After Addition of Bioslurry in Cultivation Media

Adding Bioslurry in lemna cultivation media functions as organic fertilizer which can provide an increase in the productivity of lemna growth (Tu et al 2012). In addition, the provision of bioslurry can have a good effect on increasing the content of lemna one of which is on mineral content. The amount of minerals needed by fish is very small but has a very important function. Micro minerals are minerals whose concentrations in the body of each organism in small amounts (less than 100 mg / kg of dry feed). Based on the results of research the highest mineral content during the study contained in the treatment with the addition of 2.5% bioslurry / volume from the first week to the fourth week. While the lowest mineral content is at 0% treatment. This provides an opportunity for lemna to absorb mineral content in maintenance media, so that when applied to fish, lemna can already meet the mineral needs of fish. The need for fish in minerals is influenced by size, age, growth rate, environmental stress, and the relationship between nutrients. Mineral demand for fish is very dependent on water concentration (Setiawan et al 2007).

The content of heavy metals during the study fluctuated based on treatment. The highest Pb content was in the 1% bioslurry treatment which occurred in the second week at 2.85 ppm and the lowest in the bioslurry treatment was 0.25% and 2.5%. However, in the third to fourth week, the Pb value decreased in all treatments. When viewed from the graph the results of the study show that the administration of 0.25 and 2.5% gives the Pb value to the lemna cultivation media. Heavy metal pollution can damage the aquatic environment in terms of stability, flora and fauna diversity. Heavy metal pollution can cause changes in the structure of aquatic ecosystem, foodweb, behavior, physiological, genetic, and resistance effects. If the culture media of lemna contains high Pb, it is feared that it can accumulate with lemna and eaten by the fish. This will cause damage, if it is ingested by the fish and enter into the body tissue of the fish. The following is a graph of the Mn and Pb content shortly after the addition of bioslurry (Pictures 3 and 4).



Picture 3. Mn Content in Lemna Cultivation Media Shortly After Addition of Bioslurry



Picture 4. Pb Content in Lemna Cultivation Media Shortly After Addition of Bioslurry

CONCLUSION

Based on the research results, the treatment of adding 2.5% bioslurry to the lemna culture media produced the highest Mn value of 4.6 ppm and a Pb content of 2.92 ppm to the lemna culture media.

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