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Depuration of Blood Shell Cockle using Different Filter on the Heavy Metals (Pb and Cd) Content

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ABSTRACT— ***The existence of heavy metal in aquatic environment gives negative effects in growth, reproduction and survival rate of aquatic biota. Lead (Pb) and Cadmium (Cd) are source of pollution. Currently, the shell is indicated as aquatic pollution. This research was aimed to study the effect of different filter in depuration on the content of Pb and Cd in Anadara antiquate and determine the best filter medium, which is able to reduce the content of Pb and Cd. The research was designed using completely randomized design with 4 treatments and 5 replications. Depuration process was conducted by using filter of Gracillaria sp, zeolit and active carbon. The content of heavy metal was examined using atomic absorption spectrophotometer. The results revealed that different filter affected the content of Pb and Cd in A. antiquate. Active carbon filter exhibited the reduction of Pb and Cd of 31.5% and 28.56% respectively, it was the best filter medium used in depuration, compared to zeolite, Gracillaria sp and without filter.***

Keywords— Depuration, cookles, Anadara, heavy, metal, Pb, Cd

1. INTRODUCTION

Presence of heavy metals in the waters of a negative effect on growth, reproduction, and survival of aquatic biota. Heavy metals contained in the water will go down and settle to the bottom waters then form the sediment, and this will cause the organisms that feed on the seabed such as shrimp, crab, and mussels will have a great opportunity to be exposed to heavy metals that have been tied at the bottom water and formed sediments (Payung, 2013). Heavy metals are commonly found in marine waters is Pb and Cd. Lead (Pb) is a toxic substance that is easily accumulate in human organs and can lead to health problems such as anemia, impaired kidney function, nervous system disorders, brain and skin. Pb toxicity will be seen when the Pb consume more than 2 mg per day, the threshold of Pb may be consumed is 0.2 to 2.0 mg per day (Suksmerri, 2008).

While cadmium (Cd) is a heavy metal that is most commonly found in the environment, particularly the marine environment, as well as having a high toxic effects, even at low concentrations (Almeida et al., 2009). Cadmium is known to have a long half-life in the body of living organisms (Patrick, 2003) and generally accumulates in the liver and kidneys (Flora, 2009).

The Presence of heavy metals in aquatic environments can be discovered using indicator organisms of heavy metal pollution. Shellfish (bivalves) is often used as indicator organisms of heavy metal pollution in consideration to accumulate heavy metals from the environment, widely distributed, its sedentary life and are filter feeders (Metian et al., 2005). One of the organism that contain heavy metal is blood cockle (Anadara antiquata). According to Hidayat (2011) blood cockle (A.antiquata) is one of fishery commodity that has high economic value and as a source for nutritional needs.

However, the shells contain amount of harmful heavy metals , so it is necessary to degrade the heavy metals. Shellfish obtained from aquatic enviroments that polluted with heavy metals should be cleansed or depurated. The aim of depuration process is to decrease the risk of bacterial and heavy metals contaminantion that are harmful for human health. According to Keputusan Menteri Perikanan dan Kelautan No. 17 tahun 2004, depuration process is a cleansing method using circulation system device. The fundamental of depuration process is purication of organism on controlled condition (Gabr and Gab-Alla, 2008). This research using recirculation system by recirculation device with different filters, the filters that are used are seaweed (Gracilaria sp.), zeolit and active charcoal.

2. MATERIALS AND METHOD

Tools that were used during this research are 20 aquariums (45 cm x 20 cm x 25 cm), filter, pump water filter, small pipe, fruit basket, wooden hook, water quality instruments (thermometer, pH meter, refraktometer and DO meter). Material that were used in this research are seawater, Gracillaria sp., zeolit, activated charcoal and blood cockle (A. antiquata) with size around 3.0 – 4.0 cm, 10 organisms for each aquarium (Prihatini, 2013).

Research will be carried out by maintaining blood cockle for 3-4 days in an aquarium containing seawater with different filters. Before the treatment began, each aquarium were given a challenge test heavy metals Pb and Cd respectively 1 ml in 10 liters of water and left exposed for 1 day. This is done to give the same amount of Pb and Cd for each blood cockle, so that reduction of heavy metals can be examined.

Atomic Absorption Spectrophotometer (AAS) performed before and after treatment to determine the content of heavy metals at the beginning and end of the treatment on blood cockle. For AAS test, 25 mg of shellfish meat was taken for each sample. AAS test conducted at the Laboratory of Chemistry, Universitas Negeri Surabaya. The fundamental work of AAS are, the amount of energy absorbed is proportional to the concentration of heavy metals in the sample (APHA 2005). .

3. RESULT AND DISCUSSION

3.1. Result of Pb content analysis

Result of Pb heavy metal content analysis before treatment was 2,054 ppm, Pb contents in initial testing prior to treatment is intended to compare the reduction of Pb contents after treatment. Data and graphics before and after treatment are presented in Figure 1.

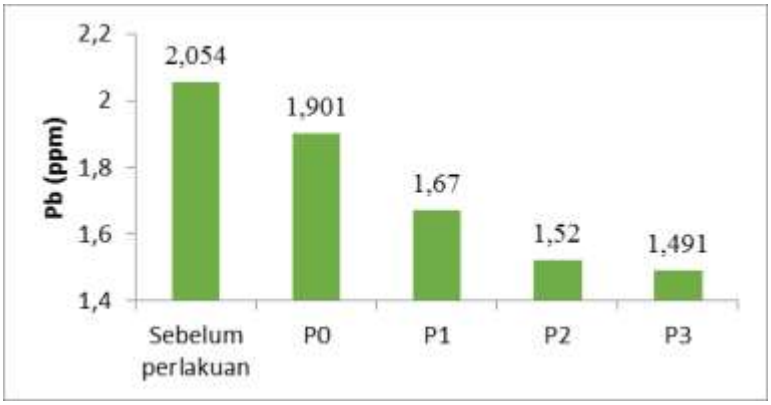

Figure 1. Graphic content of Pb Before and After Treatment

The results of the analysis on the chart above shows that the content of Pb in blood cockle (A. antiquata) after treatment was decreased. From the graph above it can be seen that the content of Pb in treatment P3 which is 1,49 ppm is lower than P2 which is 1.52 ppm and P1 which is 1.67 ppm. This shows that the treatment P3 (using activated charcoal filter) has the lowest Pb contents.

3.2. Precentage of Pb content reduction

Result of pb content analysis in blood cockle(A. antiquata) before and after treatment were calculated to determine the percentage of Pb contents reduction. Data and diagrams precentage of average Pb content reduction analysis can be seen in table 1 and figure 2.

Table 1. The average percentage decrease of Pb

Treatments	Pb Contents ± SD
P0 (without filter)	15,60%[a] ± 2,93
P1 (*Gracillaria* sp. filter)	25,53%[b] ± 2,41
P2 (zeolite filter)	30,62%[c] ± 1,46
P3 (charcoal filter)	31,50%[c] ± 1,91

Description: different superscripts in the same column indicate significant (p<0.05)

Result of Statistical test on the percentage reduction of Pb showed that treatment using activated charcoal filter on the percentage of Pb reduction is significantly different between each treatments. The highest percentage of Pb reduction found in treatment P3 (31.5%) did not differ by treatment with P2 (30.62%), but significantly different from the treatment P1 (25.53%) and P0 (15.6%).

(using activated charcoal filter) has the lowest Cd content.

3.3. Result of Cd content analysis

The results of Cd content analysis before the treatment was 2,152 ppm, the content of Cd in the initial testing prior to treatment is intended to compare the reduction of Cd content after treatment. The results of the analysis on the chart above shows that the content of Cd in blood cockle(A. antiquata) after treatment was decreased. From the graph above it can be seen that the content of Cd in treatment P3 which is 1.65 ppm is lower than P2 which is 1.71 ppm and P1 which is 1.92 ppm. This shows that the P3treatment

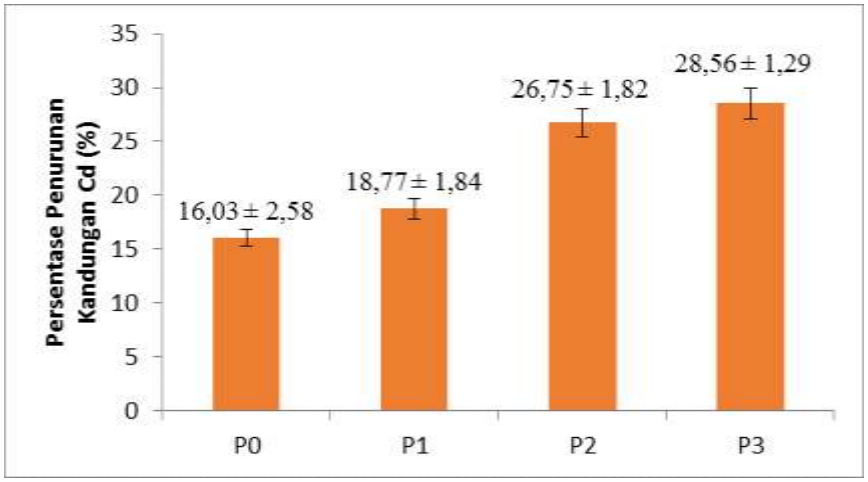

Figure 2. Graphic content of Cd Before and After Treatment

3.4. Precentage of Cd content reduction

Result of Cd content in blood cockle (A. antiquata) before and after treatment were then calculated to determine the percentage The results of statistical tests indicate the percentage of Cd reduction shows that treatment using activated charcoal filter is significantly different on each treatments. The percentage of Cd content reduction is highest in treatment P3 (28.56%) did not differ by treatment with P2 (26.75%), but significantly different from the treatment P1 (18.77%) and P0 (16.03%).

Table 1. The average percentage decrease of Cd

Treatments	Cd Contents± SD
P0 (without filter)	16,03%[a] ± 2,58
P1 (*Gracillaria* sp. filter)	18,77%[b] ± 1,84
P2 (zeolite filter)	26,75%[c] ± 1,82
P3 (charcoal filter)	28,56%[c] ± 1,29

Description: different superscripts in the same column indicate significant (p<0.05)

4. DISCUSSION

4.1. Heavy metal pb content analysis

From this research data of be sampled blood cockle A.antiquata before depuration were obtained, the result shows that shellfish meat contain 2,054 ppm of Pb contents before depuration. Other data obtained prior to treatment are water

data samples prior to treatment, Pb content in the sampling of the water in the aquarium experiment was 2,233 ppm. And data of water after the treatment also becomes the supporting data, the treatment of P1 which is 1,943 ppm, P2 which is 1,882 ppm, and P3 which is 1,802 ppm. Data of water samples was necessarily analyzed to tknow lead content in water that will be used for medium of blood cockle (A.antiquata). Decree of the Minister of Marine and Fisheries Number: KEP.17 / MEN / 2004 on oyster Sanitation Systems in Indonesia, has set the quality standard for these kinds of living shells, and its processed products that are consumed immediately. Associated with heavy metal threshold limits, oyster and its processed products that will be consumed must meet these requirements, including a maximum content of mercury (Hg), cadmium (Cd) and lead (Pb), respectively 0.5; 1.0; and 1.5 mg / kg net weight.

To reduce the amount of Pb in blood cockle A. antiquata depuration process was conducted through four treatments with five replications using completely randomized design. Data obtained from these research shows significantly difference to the different treatment filtesr, which means that different filters shows different depuration result than treatment that was not use a filter

Different filters are given for 3 days and the results obtained by using activated charcoal filter in general tend to have higher Pb content reduction with a percentage of 31.5% compared with zeolite filter which is 30.62% and the gracillaria sp filter which is 25.53% .This shows that the different filters on Pb content reduction in blood cockle (A. antiquata) was more effectively deliver a reduction than without filters that average is only 15.6%.

4.2. Heavy metal Cd content analysis

From this research data of be sampled blood cockle A.antiquata before depuration were obtained, the result shows that shellfish meat contain 2,152 ppm of Cd contents before depuration. Other data obtained prior to treatment are water data samples prior to treatment, Cd content in the sampling of the water in the aquarium experiment was 2,301 ppm. And data of water after the treatment also becomes the supporting data, the treatment of P1 which is 2,083 ppm, P2 which is 1,967 ppm, and P3 which is 1,853 ppm. Data of water samples was necessarily analyzed to tknow Cd content in water that will be used for medium of blood cockle (A.antiquata). Decree of the Minister of Marine and Fisheries Number: KEP.17 / MEN / 2004 on oyster Sanitation Systems in Indonesia, has set the quality standard for these kinds of living shells, and its processed products that are consumed immediately. Associated with heavy metal threshold limits, oyster and its processed products that will be consumed must meet these requirements, including a maximum content of mercury (Hg), cadmium (Cd) and lead (Pb), respectively 0.5; 1.0; and 1.5 mg / kg net weight.

To reduce the amount of Cd in blood cockle A. antiquata depuration process was conducted through four treatments with five replications using completely randomized design. Data obtained from these research shows significantly difference to the different filter treatment, which means that different filters shows different depuration result than treatment that was not use a filter

Different filters are given for 3 days and the results obtained by using activated charcoal filter generally tend to have higher Cd content reduction with a percentage of 28,56% compared with zeolite filter which is 26,75% and the gracillaria sp filter which is 18,77% .This shows that the different filters on Cd content reduction in blood cockle (A. antiquata) was more effectively deliver a reduction than without filters that average is only 16,03%.

5. CONCLUSSION

Depuration process with different filters have a significantly influence on Pb an Cd content of blood cockle (*A. antiquata*).treatment using Activated charcoal filter shows a higher Pb and Cd reduction than using zeolit filter, gracilaria filter and without filter with precentage of 31,5% on Pb and 28,56% on Cd

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