Effectiveness of Adsorption of Heavy Metal Cadmium (Cd) and Mercury (Hg) Levels on Green Mussels in Jakarta Bay by Absorption Coconut Shell Charcoal and Rice Husk Charcoal

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A R T I C L E I N F O

A B S T R A C T

Perna viridis otherwise known as "*green mussel*" is a shellfish that has high economic value, consumption of green mussels in Indonesia reaches 50,000 tons per year, and most of it comes from Jakarta Bay. Apart from being nutritious, shellfish are also often a source of food poisoning, research results on green mussels in Jakarta Bay almost all heavy metals are in it. The aim is to determine the Effectiveness of Adsorption of Heavy Metal Cadmium (Cd) and Mercury (Hg) Levels in Jakarta Bay Green Mussels Using Coconut Shell Charcoal and Rice Husk Charcoal at the Environmental Health Laboratory in 2023, this research method is experimental to determine the effectiveness of using variations of activated charcoal from coconut shells and rice husks in absorbing heavy metals in green kerrang from Jakarta Bay, this research was carried out in 2 stages over 2 years. Phase I of the research tested the effectiveness of variations in activated charcoal absorbent and the results of phase I showed that variations in the composition of activated charcoal from coconut shells and husks rice are as follows: A (control) B (100% CS), C (100% RH,) D (75% CS, 25% RH) E (50% CS, 50% RH), F (25% CS, 75% RH) with varying lengths of soaking time in water (0 minutes, 30 minutes, 60 minutes and 90 minutes) produced the most effective value in absorbing Cd (Cadmium) in all variations of activated charcoal composition and produced <0.033 mg/l in all research time variations are by SNI-06-6989.16-2004, while the results of statistical tests for the most effective absorption of mercury are in Variations A6, A9, B3, B6, B9, C3, C6, C9, D3, D6, D9 results < 1 mg / l meets the requirements according to SNI-06-6989.16-2004. It can be concluded that the higher the % composition of Rice Husk, the less effective it is in absorbing mercury levels in green mussels.

Keywords: Activated Charcoal, Absorption, Heavy Metal, Green Mussels.

I. INTRODUCTION

Green clams (Perna viridis) otherwise known as "green mussel" are shellfish that have high economic value. Shellfish contain high nutritional value and are popular with the public. Green mussels are animal filter feeders or suspension feeders. Because of this way of eating, green mussels are useful as biofilters in aquatic areas [1]. According to the Directorate General of Capture Fisheries (2015), the value of shellfish production increases annually by 3,220.92 tons [2]. According to research in saying that green mussels (Perna viridis) have great potential to be exploited because their population is quite large in Indonesian waters [3].

If heavy metals in waters exceed the quality standard limits, they are said to be pollutants [4]. Along with the increase in industry in Indonesia, waste discharge from industry also increases, both from organic and inorganic materials, in the form of solids or liquids containing heavy metals, for example, Cadmium (Cd). As a result of current water conditions, green mussels are starting to contain lots of heavy metals. In waters, this heavy metal is a strong and chronic poison for humans, fish, shellfish, and possibly other organisms, even the solubility of cadmium in certain concentrations can kill aquatic biota [5]. If consumed continuously, this can endanger the health of the human body [6]. The heavy metal Cd can cause an increase in blood pressure (Liliandari and Aunurohim, 2013). Acute exposure to cadmium (Cd) causes symptoms of nausea, vomiting, diarrhea, muscle cramps, anemia, dermatitis, slow growth, kidney and liver damage, cardiovascular disorders, emphysema, and degeneration testicular.

Green mussels that come from Jakarta Bay have almost all the heavy metals in them. Namely Hg (mercury), Cd (cadmium), Pb (lead), Cr (chrome), and Sn (tin) are high so they are dangerous and can cause poisoning [7]. Acute Hg poisoning can cause damage to the digestive tract. Hg pollution occurs due to the disposal of industrial waste, oil sludge containing high concentrations of heavy metals, and the burning of oil (hydrocarbons) and coal on land. They release heavy metals into the atmosphere where they then occur mixed [8]. Laboratory examination shows denaturation of inactive enzyme proteins and damage to cell membranes [9]. Efforts to reduce heavy metal content can be made by adding activated charcoal during the boiling process. Previous research results Coconut shell charcoal has a higher carbon content so it has the potential to be a source of active carbon that can absorb heavy metals. Research by Herlandien shows that coconut shell-activated charcoal with 1 M NaCl activator can reduce Cadmium (Cd) levels by 72.5% in landfill leachate and coconut shell-activated charcoal can reduce Mercury (Hg) levels by 99.8150% in water [10]. Gold mining waste. Therefore, coconut shells can be used as absorbents for heavy metals. Apart from coconut shells, rice husks are also processed as activated charcoal. Rice husks can be used as a planting medium and activated charcoal [11-12]. Activated charcoal from rice husks can be used as a heavy metal absorbent. The results of research on coconut shell charcoal can reduce Cadmium up to 65.3% and rice husk charcoal can reduce Hg levels up to 100% in waste tailing spindle [13].

In current conditions, people only use charcoal to reduce heavy metal content, so it is necessary to absorb heavy metals through two processes, namely adsorption and absorption [14]. Based on these conditions, this research was conducted to determine the effectiveness of adsorption of the heavy metal levels Cadmium (Cd) and Mercury (Hg) on Green Mussels in Jakarta Bay using Coconut Shell Charcoal and Rice Husk Charcoal Absorbents at the Environmental Health Laboratory in 2023. The specific objectives of this research: to obtain active charcoal content from variations of coconut shell charcoal and rice husks, to determine the effectiveness of heavy metal adsorption on green mussels with absorbents of variations of coconut

shell and rice husk activated charcoal, to determine the effective contact time for heavy metal adsorption on shellfish. Green, to find out the level of stability and accuracy of various active charcoal formulations in adsorbing heavy metals in green mussels.

The results of this research show that variations in the composition of activated charcoal from coconut shells and rice husks are as follows: A (control) B (100% TK), C (100% SP) D (75% TK, 25% SP) E (50% TK .50% SP), F (25%TK,75%SP) with variations in the length of soaking time in water (0 minutes, 30 minutes, 60 minutes and 90 minutes) produces the most effective value in absorption of Cd (Cadmium) in all variations of activated charcoal composition and produced <0.033 mg/l at all variations in research time by SNI-06-6989.16-2004, while the results of statistical tests for the most effective absorption of mercury were in Variation A6, A9, B3, B6, B9, C3, C6, C9, D3, D6, D9 results < 1 mg / l have fulfilled the requirements according to SNI-06-6989.16-2004. It can be concluded that the higher percetage the composition of Rice Husk, the less effective it is in the absorption of mercury levels in green mussels.

II. METHODS AND MATERIAL

Research methods

This research uses an experimental method by calculating the effectiveness of adsorption of heavy metal levels of cadmium (Cd) and mercury (Hg) on Jakarta Bay green mussels using coconut shell charcoal and rice husk charcoal at the Environmental Health Laboratory in 2023. The research location is Muara Angke Village, North Jakarta and the Environmental Health Laboratory, research time is from March 2023 to November 2023. The population of this research is l Green Mussels on the Coast of North Jakarta, while the samples were taken from Green Mussels in Muara Angke Village, North Jakarta. Effectiveness of Adsorption of Heavy Metal Cadmium (Cd) and Mercury (Hg) Levels in Jakarta Bay Green Mussels Using Coconut Shell Charcoal and Rice Husk Charcoal Absorbents. The research process is as follows: Coconut Shell Charcoal Manufacturing, Making Rice Husk Charcoal, Activation and production of activated charcoal concentration, Shell Charcoal 25%, Rice Husk Charcoal 75%, Shell Charcoal 50%, Rice Husk Charcoal 50%, Shell Charcoal 75%, Rice Husk Charcoal 25%, Shell Charcoal 25%, Rice Husk Charcoal 75%, Each of them was placed in the soaking water for the Green Mussels, each receiving the same treatment with a contact time of 30 minutes, 60 minutes and 90 minutes. Each machine was checked for heavy metal content (Cd and Hg) before and after the intervention. Calculate the effective level of absorption using AAS examination.

TABEL 1. Distribution of variations in activated charcoal and length of soaking time

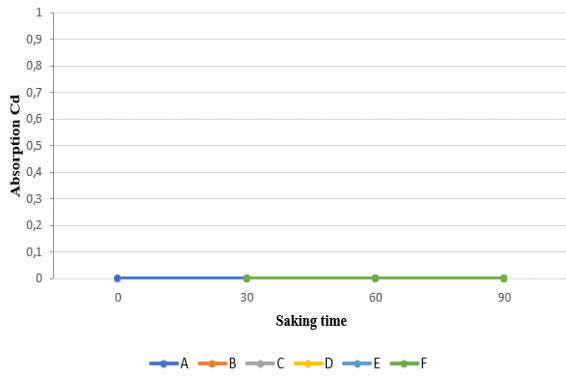| Number	Water ± 2,5 liters	Mixer 5 minutes	Mussels 250 gr	Activated Charcoal (%)	30 mitutes	60 mitutes	90 mitutes
A	Done	Done	Done	Not	Done	Done	Done
B	Done	Done	Done	CS 100	Done	Done	Done
C	Done	Done	Done	RH 100	Done	Done	Done
D	Done	Done	Done	CS 75, RH 25	Done	Done	Done
E	Done	Done	Done	CS 50, RH 50	Done	Done	Done
F	Done	Done	Done	CS 25. RH 75	Done	Done	Done

FIGURE 1. Distribution of the results of using variations of activated charcoal and variations of soaking on the results of Cd adsorption on Green Mussels
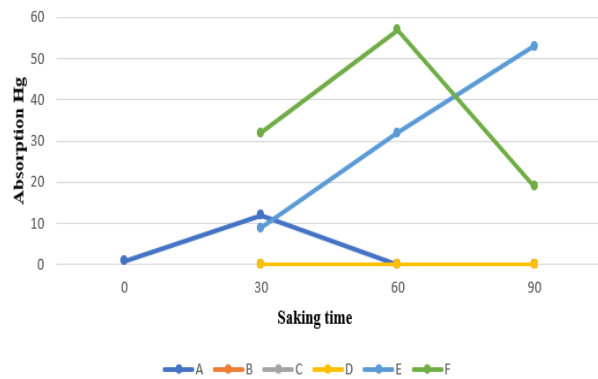

FIGURE 2. Distribution of the results of using variations of activated charcoal and variations of soaking on the results of Hg adsorption on Green Mussel

Data analysis techniques

The data analysis stage begins: for the level of effectiveness, use multi variate analysis, to measure activated charcoal levels using the Activation method and, for measuring heavy metal content using the LCPMS method with AAS.

III. RESULTS AND DISCUSSION

Research on the Effectiveness of Adsorption of Heavy Metal Cadmium (Cd) and Mercury (Hg) Levels on Jakarta Bay Green Mussels Using Coconut Shell Charcoal and Rice Husk Charcoal Absorbents at the Environmental Health Laboratory in 2023 has been carried out by conducting adsorption effectiveness tests using variations of activated charcoal from coconut shells. and rice husks in absorbing heavy metals in green mussels from Jakarta Bay, the results of research in phase I, the data obtained in this implementation are as follows show in Table.1.

Each basin containing 2.5 liters of water is each filled with a variation of activated charcoal: A (without activated charcoal) B (+ 100% Coconut Shell Activated Charcoal) C + 100% Rice Husk Activated Charcoal, D (AA Coconut Shell 75 %, Rice Husk 25%, E (AA Coconut Shell 50%) and Rice Husk 50%, F (AA Coconut Shell 25% and Rice Husk 75%) with a soaking time range of 30 minutes, 60 minutes and 90 minutes. Distribution of the results of using variations of activated charcoal and variations of soaking on the results of Cd adsorption on Green Mussels show in Figure 1 and, Distribution of the results of using variations of activated charcoal and variations of soaking on the results of Hg adsorption on Green Mussels show in Figure 2.

Based on the results in the table above, it was found that by examining cadmium (in group A) all variables had the same significance value (P-Value), namely 0.031 (<0.05) show in Figure.3. From the results of these tests, it can be interpreted that all variables have a significant effect in reducing the concentration of cadmium in clean water, both for all variations of activated charcoal and the different soaking times, namely 30 minutes, 60 minutes and 90 minutes.
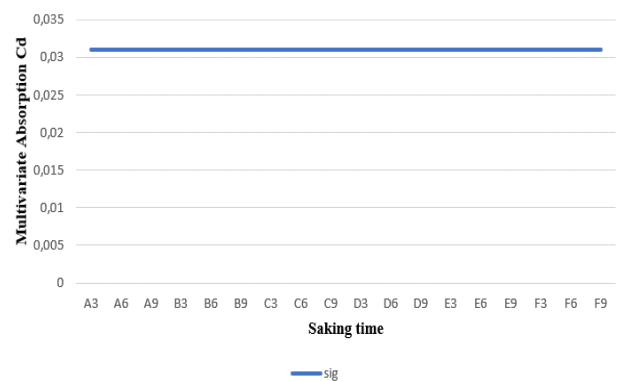

FIGURE 3. Results of multivariate analysis of the level of adsorption of the heavy metal Cd on green mussels
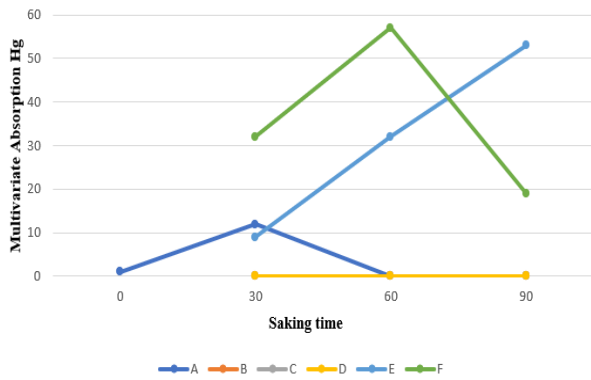
FIGURE 4. Results of multivariate analysis of the level of adsorption of the heavy metal Hg on green mussels

Based on laboratory test results, it was found that the results of cadmium concentration in all types of treatment and time variations had the same value, namely <0.033 mg/l with a cadmium quality standard of 0.005 mg/l show in Figure 4. It was found that variations in the composition of activated charcoal from coconut shells and rice husks were as follows: A (control) B (100% TK), C (100% SP,) D (75% TK, 25% SP) E (50% TK, 50 % SP), F (25%TK,75%SP) with variations in the length of immersion time in water (0 minutes, 30 minutes, 60 minutes and 90 minutes) produces the most effective value in absorption of Cd (Cadmium) in all variations of activated charcoal composition and produced <0.033 mg/l at all variations in research time in accordance with SNI-06-6989.16-2004, while the results of statistical tests for the most effective absorption of mercury were in Variation A6, A9, B3, B6, B9, C3, C6, C9, D3, D6, D9 results < 1 mg / l have fulfilled the requirements according to SNI-06-6989.16-2004. It can be concluded that the more % composition of Rice Husk, the less effective it is in absorption of mercury levels in green mussels.

IV. CONCLUSION

Variations in the composition of activated charcoal from coconut shells and rice husks are as follows: A (control) B (100% TK), C (100% SP,) D (75% TK, 25% SP) E (50% TK, 50% SP), F (25%TK,75%SP) with

variations in the length of soaking time in water (0 minutes, 30 minutes, 60 minutes and 90 minutes) produced the most effective value in absorbing Cd (Cadmium) in all variations in the composition of activated charcoal and produced <0.033 mg/l at all variations in research time in accordance with SNI-06-6989.16-2004, The results of the statistical test for the most effective absorption of mercury are Variations A6, A9, B3, B6, B9, C3, C6, C9, D3, D6, D9, the results are < 1 mg / l which meets the requirements according to SNI-06-6989.16 -2004 it can be concluded that the greater the % composition of Rice Husk, the less effective it is in absorbing mercury levels in green mussels.

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