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HEAVY METAL CONTENT OF LEAD (PB) IN COMB PEN SHELL (*ATRINA PECTINATA*) IN INDUSTRIAL CITY WATERS

Tri Sudarsono, Boedi Setya Rahardja and Kustiawan Tri Pursetyo
Department of Fisheries and Marine, Faculty of Fisheries and Marine, Airlangga University, Indonesia, 60115

ABSTRACT

Comb pen shells (Atrina pectinata) are one of marine biota in industrial city waters, which are threatened by contamination of lead heavy metal (Pb) from industrial and inorganic waste. One way to see the size of the content of lead heavy metal (Pb) in comb pen shells is through the size of shells. This study aimed to determine the content of lead (Pb) in comb pen shells (Atrina pectinata) in industrial waters and to determine the correlation between the size of comb pen shells and the content of lead (Pb) in comb pen shells in industrial city waters. The observational results showed there was lead (Pb) content in comb pen shells (Atrina pectinata) in industrial city waters based on various sizes, which were large (1.147 mg/kg), medium (0.133 mg/kg), and small (0.084 mg/kg). The statistical analysis showed the calculation of lead content (Pb) in comb pen shells with various sizes had a correlation value of 0.618. Mean of lead content in comb pen shells (Atrina pectinata) based on various sizes, none of which had exceeded the quality standards that were allowed for lead heavy metal and the correlation of comb pen shells of different sizes had a strong relationship.

Keywords: Heavy Metals of Lead (Pb), Comb Pen Shells (*Atrina pectinata*), Industrial City Waters

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1. INTRODUCTION

Comb pen shells (*Atrina pectinata*) live in habitats from muddy to sandy sediments and from tidal flats to shallow subtidal environments up to 20 m in depth (1). This type of shellfish is a popular dietary source that has high economic value and is widely distributed throughout the

Western Indo-Pacific region, Africa, Malaysia, New Zealand and Japan (2), including in Indonesia. Comb pen shells (*Atrina pectinata*) are easily exposed to waste (3), include lead metal (Pb) which is generated from industrial waste.

Lead (Pb) is one of the heavy metals that is very dangerous for human health and is can not be decomposed by natural processes (4). Industrial waste and human activities will flow into the river and eventually enter the waters of the sea. This type of waste, such as organic and inorganic waste (garbage), that can cause the water system become polluted. Seawater is a component that interacts with the terrestrial environment, where waste from land will empty into the sea, waste containing pollutants will enter the coastal and marine ecosystems, some dissolve in water, some sink to the bottom and concentrated into sediments, and some enter into the body tissues of marine organisms (5), can even cause the death of marine organisms (6).

The size of shellfish is one of the factors that affect the concentration of heavy metals in the body. Large shell is positively correlated with increasing age. Increasing age is also positively correlated with increasing heavy metal concentrations in the body (7). Based on the statements above, the aim of this study was to determine the lead (Pb) content of comb pen shells (*Atrina pectinata*) in industrial city waters as well as to determine the correlation between the size of comb pen shells and lead (Pb) content in comb pen shells in industrial city waters.

2. METHODS

2.1. Research Tools

The research tools used for sampling were cool box and 5 kg plastic bag. Tools for analysis of lead in water samples, sediments and comb pen shells were analytical scale (accuracy of 0.0001 g), beaker glass of 50 ml, 50 ml labut, knife, cupboard, desiccator, oven, micropipette, and Atomic Absorption device Spectrophotometry (AAS).

2.2. Research Materials

The materials used in this study were samples of comb pen shells (*Atrina pectinata*) and ice cubes. In the shellfish samples, several captured shells were taken, then grouped according to the size of the shells, small (length <26 cm), medium (long = 26-37 cm) and large (length >37 cm) (WWF-Indonesia, 2015) taken from every fisherman. Materials for analysis of lead in comb pen shells included concentrated HNO_3 solvents, distilled water and acetylene fuel.

2.3. Methods

This study used observation method by taking a sample of ± 50 shells. Determination of sampling was done by purposive sampling which was based on the catch of fishermen in several traders with various sizes of shells. Determination of sampling was chosen based on the location or centers of shellfish sales for the local population. Samples of comb pen shells (*Atrina pectinata*) were carried out in industrial city waters (Kenjeran beach area, Surabaya city, Indonesia) in November 2017. Whereas, analysis of lead (Pb) in comb pen shells was comducted in Testing and Industrial Baristand Calibration Laboratory, Surabaya city, Indonesia.

The groups of comb pen shells were put into a plastic bag that had been marked for each station and then stored in a cool box for observation of lead content in the laboratory. The samples to be tested in the laboratory will be given the following information:

A = Large sized comb pen shells (>37 cm long)

B = Medium sized comb pen shells (length = 26-37 cm)

C = Small sized comb pen shells (length <26 cm)

The examination of lead in water samples, sediments and comb pen shells was done using Atomic Absorption Spectrophotometry (AAS) with the Lambert-Beert Law principle. The optimum condition of the analysis of lead elements in the AAS tool was obtained by measuring absorption at a wavelength of 283.3 nm.

2.4. Research Parameters

The research parameters included the main parameter and supporting parameters. The main parameter observed was lead (Pb) content in comb pen shells (*Atrina pectinata*) in industrial city waters. Supporting parameters included water quality, namely temperature, salinity, pH, dissolved oxygen (DO) and brightness. The water quality was measured using refractometer, thermometer, DO kit, pH paper and Secchi disk.

3. RESULTS

Heavy Metal Content of Lead (Pb) in Comb Pen Shells (Atrina pectinata)

Based on the results of the examination of lead metal content (Pb) in Testing and Industrial Baristand Calibration Laboratory, Surabaya city, Indonesia, showed the content of lead (Pb) in comb pen shells (*Atrina pectinata*) in industrial city waters. The results of the mean content of lead in comb pen shells (*Atrina pectinata*) taken in industrial waters based on various sizes are presented in Table I.

Table I. Mean content of lead (Pb)

Comb pen shells (mg/Kg)		
Large	**Medium**	**Small**
1.1474 ± 2.699	0.133 ± 0.077	0.084 ± 0.700

Relationship between Lead (Pb) Content in Comb Pen Shells in Industrial City Waters

The size of the comb pen shells affected the amount of lead (Pb) in the comb pen shells. This is due to the filter feeder nature of the comb pen shells. The larger size and the longer age will increase the lead (Pb) content in the shells. Comb pen shells get food by filtering the water that enters the body. Based on the correlations analysis showed the correlation coefficient was 0.618. R^2, which was the coefficient of determination, had the value of R^2 = 0.382, that meant the contribution of variable X to variable Y was 38.2%.

The regression equation of the relationship between the size of comb pen shells and the content of lead (Pb) formed is $y = 1{,}108\text{-}908X_1 + 7{,}249X_2 + 0{,}004X_3$. A positive (+) sign on the size of a large shell shows a direction, so that if the size of the shells rises or the size of the shells increases, the content of lead (Pb) of shellfish will rise, and vice versa.

A positive (+) sign on the size of the shellfish shows a direction, so that when the shell size is getting bigger, the content of lead (Pb) of shellfish will be higher, and vice versa. The negative sign (-) on the size of the small shells shows the opposite direction, so that if the size of the shells gets smaller, then the content of lead (Pb) of shellfish will be reduced, and vice versa.

4. DISCUSSION

Comb pen shells can accumulate metals that larger than other aquatic animals because they are sedentary, can filter their food (filter feeders), and are slow to avoid the effects of

pollution. Based on the results of this study showed the comb pen shells (*Atrina pectinata*) have heavy metal content of lead (Pb) that has not exceeded the quality standard. The content of lead (Pb) in comb pen shells in the industrial waters of the city is influenced by many factors, one of which is related to how comb pen shells eat as the filter feeders. In the filter feeder process, shells filter the food that enters the body. When the food enters the body of the comb pen shells, the particles of heavy metal will be absorbed into the body, so that the more food is filtered, the more heavy metal in the body of the comb pen shells will be.

Lead (Pb) content in comb pen shells of various sizes has not exceeded the quality standards that are permitted for Pb of 1.5 mg/kg (SNI 7387: 2009). However, comb pen shells in industrial city waters have been contaminated by lead. This is due to the high pollution of Pb from rivers that contaminated by pollutant waste which empties into industrial city waters. In addition, it is caused by waste originating from industrial waste around the Kenjeran coast, Surabaya city in the Madura strait waters, which can affect industrial city waters. Comb pen shells have lead (Pb) content which is different in each size, because it is influenced by several factors, such as age and continuous water movement. Eventhough heavy metals are deposited in the waters, the influence of direction and current velocity are quite influential on the content of heavy metals in water which will be accumulated by shells.

Based on correlation analysis between lead content (Pb) in comb pen shells with various sizes had R value of 0.618. This shows that the relationship between X and Y was a strong and positive relationship, which means that the increase in lead content (Pb) in different shells can increase the lead content (Pb) in the comb pen shells. Parameter X was said to affect the parameter Y, if the change in parameter X will cause changes in parameter Y. The correlation coefficient between shell size is different from the lead content of comb pen shells. This can be caused by the large amount of lead carried from the river due to human and industrial activity so that lead content comb pen shells were increasing.

The amount of lead in shells of different sizes will affect the amount of lead in the shell. The calculations also showed that R_2 was 0.382 or 38.2%, indicating that the contribution of sea water lead to variation Y (Pb content in shellfish) of 38.2%, while the rest (61.8%) was influenced by other factors.

5. CONCLUSION

Based on the results of the analysis and discussion in this study, it can be concluded that there were lead content (Pb) in comb pen shells (*Atrina pectinata*) in industrial city waters of various sizes, which are large (1.147 mg/kg), medium (0.133 mg/kg), and small (0.084 mg/kg). This shows the average lead content in comb pen shells (*Atrina pectinata*) based on various sizes none of which have exceeded the quality standards that are allowed for Pb of 1.5 mg/kg (SNI 7387: 2009). The calculation results of the correlation of lead content (Pb) in comb pen shells with various sizes had R or a correlation of 0.618. This shows that there is a strong relationship between X and Y.

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