

*Assessment of Heavy Metals in Blood Clams (*Anadara granosa*) in the Waters of the East Coast of Jambi, East Tanjung Jabung Regency, Jambi, Indonesia*

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Abstract – This study was conducted to determine the levels of heavy metals Lead (Pb), Mercury (Hg) and Cadmium (Cd) in blood clams and seawater in the waters of Jambi East Coast, East Tanjung Jabung Regency. Measurement of Pb, Hg and Cd levels in blood clams and seawater using APHA Method/Tools, 23rd Edition, GFAAS Extraction and Cold Vapor. The results of this study obtained the content of heavy metals Lead (Pb), Mercury (Hg) and Cadmium (Cd) in blood clams all exceed the threshold set by the Quality Standard based on PPRI No.22 of 2021 Appendix VIII, for seawater all still within normal limits do not exceed the threshold set by KEPMENLH Number 5 of 2014.

Keywords – Heavy Metals, Blood Clams, Seawater.

I. INTRODUCTION

Blood clam (*Anadara granosa*) is one of the animals that people are interested in consuming at a relatively high price *Anadara granosa* or commonly called blood clam is one type of bivalve member of Arcidae which has the potential and economy to be developed as a source of protein and minerals. This clam is commonly consumed by the community (Ambarwati & Trijoko, 2011, 2010; Dharma, 2005). As with the type of bivalves Alyani et al: Cadmium (Cd) Heavy Metal Content 9 other bivalves, blood clams live on the surface of mud in shallow waters and settle in one place, due to their slow movement. The sedentary way of life and filter feeder or eating by filtering water causes blood clams to easily accumulate heavy metals in their bodies (Darmono, 2001).

Heavy metals commonly found in blood clams include cadmium (Cd). The increase in cadmium levels in blood clams is increasing in line with the growing industrialization process (Widowati, 2008). Cadmium is one type of heavy metal that is harmful to human health. Some of the negative impacts that can be caused by cadmium metal include damage to the kidneys, liver, testes, immune system, nervous system, and circulatory disorders. Cadmium is dangerous because it can accumulate in the body and when it reaches high levels, it will attack the body's organs, especially the kidneys and lungs (Mifbakhuddin et al., 2010). Indonesian National Standard (SNI) No. 7387: 2009 on the Maximum Limit of Heavy Metal Contamination in food is below 1 ppm for cadmium.

Based on the description above, it is necessary to identify heavy metals found in blood clams found in the waters of East Tanjung Jabung Regency which includes Kuala Jambi waters, Simbur Naik Waters, so that later there will be a way to overcome heavy metal problems if indicated heavy metals are found in blood clams and sediments in the waters.

II. METHODOLOGY

Research Location

The location and plot of the research were determined based on the habits of the community to collect blood clams. The sampling location was divided into 7 stations with a distance of 100 m for each station. The distance was based on the representation of the location so that a total of 7 stations were set at 2 water locations (Figure 1).

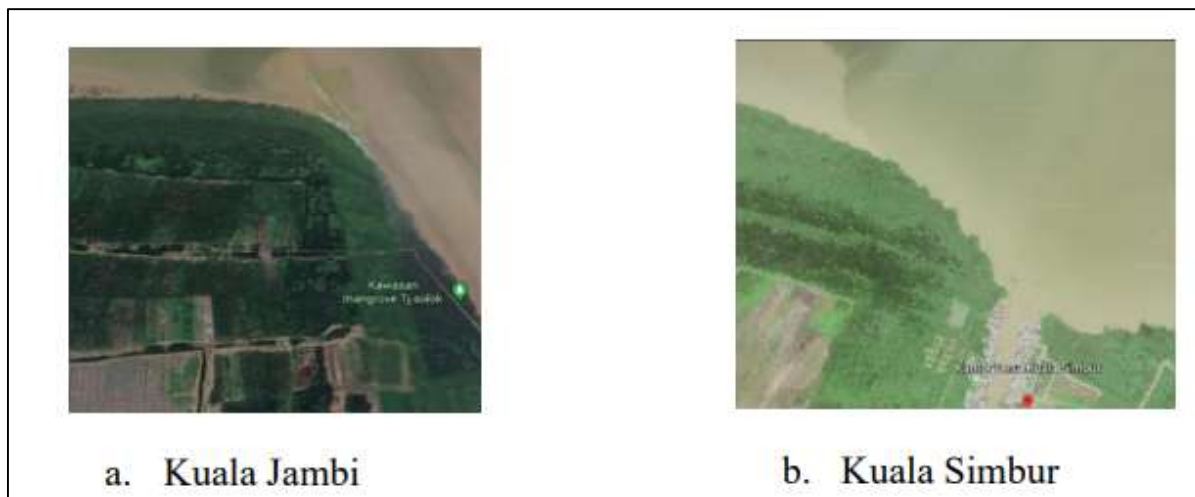


Figure 1. Sampling location

Each station consisted of 2 quadrat transects with 3 plots measuring 1 x 1 meter. The distance between plots was 5 meters while the distance between each transect was 50 meters. The transect line is perpendicular to the shoreline at the highest tide towards the lowest low tide. The determination of transects refers to Fachrul (2007), which states that in determining the transect quadrats in coastal aquatic ecosystems, transects are installed at low tide.

Sampling

Blood clam sampling was conducted at low tide in the beach area. Blood clam sampling was conducted using the transect method by placing each transect on a predetermined plot. Blood clams were sampled where the samples were taken randomly. Blood clams that have been obtained are put into a labeled plastic bag that has been given formalin liquid with a concentration of 5%. Water and sediment sampling for environmental parameter analysis is carried out simultaneously with the sampling of blood clams. Water and sediment samples to be analyzed are put into bottles that have been coated with aluminum foil and analyzed in the laboratory.

Data Analysis

Data analysis carried out includes analysis of heavy metals Lead (Pb), Mercury (Hg) and Cadmium (Cd) in marine biota compared to the threshold values issued by PPRI No. 22 of 2021 Appendix VIII and for seawater compared by KEPMENLH Number 5 of 2004 (Table. 1).

III. RESULTS AND DISCUSSION

Heavy metals that enter the water will undergo a process of deposition and accumulate in sediments, then accumulate mainly in the body of marine biota that settled and heavy metals will be concentrated into the body of living things with the process of bioaccumulation and biomagnification through several ways, namely through the respiratory tract, food channels and through the skin. A group of organisms capable of accumulating heavy metals are bivalves. This ability makes bivalves a bioindicator of waters (Dahuri et al. 1996 in Putri, 2010).

Table 1. Threshold values of heavy metals

Logam Berat	Marine Biota (mg/Kg)	Ocean Water (mg/Kg)
Timbal (Pb)	0,008	0,05
Kadmium (Cd)	0,001	0,01
Merkuri (Hg)	0,001	0,003

Levels of Lead (Pb) in Blood Clams

Based on the results of the study, the levels of Lead (Pb) in blood clam meat are presented in Fig. 2.

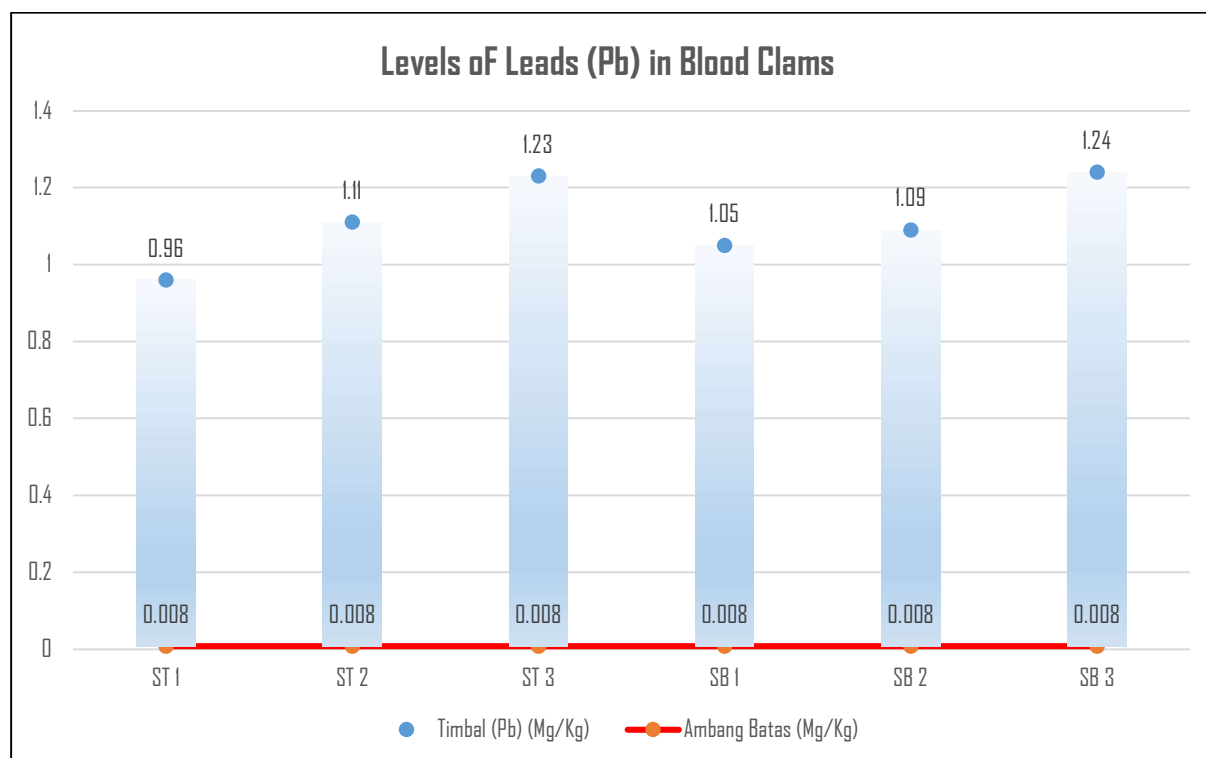


Figure 2. Lead (Pb) levels in blood clams.

The highest heavy metal lead (Pb) content in clam meat was at West Station (SB) 3 at 1.24 Mg/Kg and the lowest was at East Station (ST) 1 at 0.96 Mg/Kg, both of which exceeded the PPRI No. 22 of 2021 threshold of 0.008 Mg/Kg. Pb levels in shellfish according to BPOM are not suitable for consumption. The recommended consumption limit for food contaminated with heavy metal lead (Pb) is 0.025 mg/kg body weight (equivalent to 1.5 mg/week for an adult weighing 60 kg) (FAO, 2000). Consuming shellfish containing heavy metals will be very harmful to the health of the human body. Non-essential metals react at various levels and tend to accumulate in the body continuously, causing a decline in health that can lead to chronic diseases such as disorders of kidney function, liver function, reproductive system and nervous system (Naria, 2005; Wardani et al., 2014).

Many possibilities can be the cause of high levels of Lead in Kuala Jambi and Kuala Simbur, one of which is factory waste. Palar (in Wardana et al. 2023) explained that there is a significant risk due to heavy metal Pb pollution in the habitat of blood clams (*Tegillarca granosa*) on the beach near big cities. This is due to pollution from industrial waste disposal and port activities. The relationship between Pb concentration in seawater and blood clams is positively correlated, which means that the higher the concentration of Pb in the aquatic environment, the higher the level of Lead (Pb) absorbed by blood clams (Wardana, 2023).

Cadmium (Cd) Content of Blood Clams

Based on the results of the study, the levels of cadmium (Cd) in blood clam meat are presented in Fig. 3.

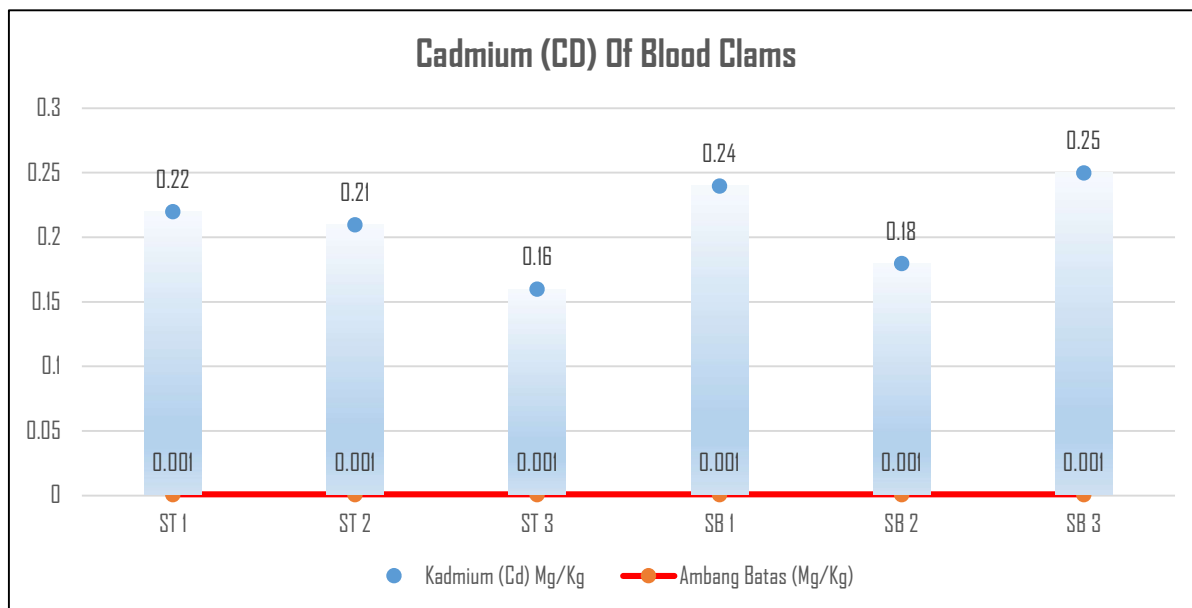


Figure 3. Cadmium (Cd) levels in blood clams.

The highest content of heavy metal Cadmium (Cd) in clam meat was at West Station (SB) 3 at 0.25 Mg/Kg and the lowest was at East Station (ST) 3 at 0.16 Mg/Kg, both of which exceeded the PPRI No. 22 of 2021 threshold of 0.001 Mg/Kg. Cadmium is one type of heavy metal that is harmful to human health. Some of the negative impacts that can be caused by cadmium metal content include damage to the kidneys, liver, testes, immune system, nervous system, and circulatory disorders. Cadmium is dangerous because it can accumulate in the body and when it reaches high levels, it will attack the body's organs, especially the kidneys and lungs (Mifbakhuddin et al., 2010). Indonesian National Standard (SNI) No. 7387: 2009 concerning the Maximum Limit of Heavy Metal Contamination in food, which is below 1 ppm for Cadmium.

Susanti et al (2016) stated that harmful toxic substances can come from industrial discharges, such as the chemical industry and industries that use heavy metals in the production process. Such waste can contaminate waters. One of these heavy metals is cadmium which can enter and accumulate in the body of marine invertebrates such as clams or bivalves. According to Tielman et al. (2018), blood clams (*A. granosa*) have the ability as bioaccumulators of various types of heavy metals, namely Hg, Cd, Cr, Cu, Zn, and Pb. This situation can certainly be fatal for organisms and for people who continue to consume them so that the negative effects of heavy metals can accumulate continuously in the human body. In addition, blood clams are one of the fishery commodities consumed by the community because of their delicious taste (Yulianto, 2006)

Mercury (Hg) Content of Blood Clams

Based on the results obtained, the levels of Mercury (Hg) in blood clam meat are presented in Figure. 4.

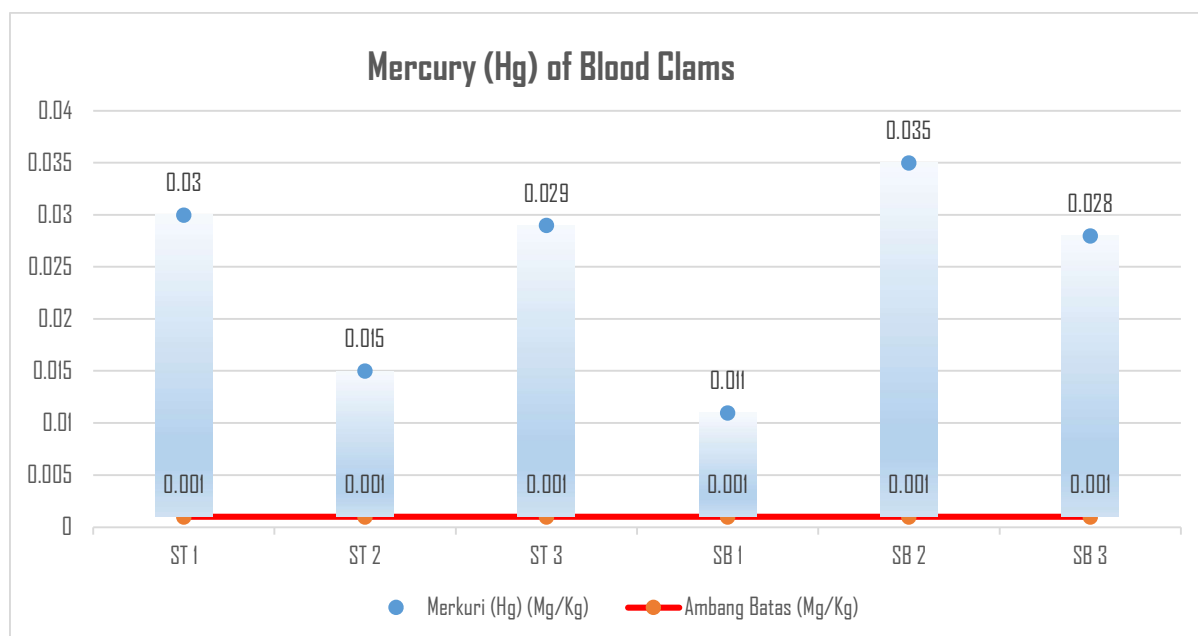


Figure 4. Mercury (Hg) content in blood clams.

The content of heavy metal Cadmium (Cd) in clam meat was highest at West Station (SB) 2 at 0.035 Mg/Kg and lowest at West Station (SB) 1 at 0.011 mg/Kg, both of which exceeded the PPRI No. 22 of 2021 threshold of 0.001 mg/Kg. Mercury that enters the human body is usually in the form of methyl mercury which will have impacts such as: difficulty speaking, hearing and walking, muscle weakness, lack of coordination of body movements, loss of ability to see clearly, tingling or numbness around the hands, feet, and around the mouth (Alfian, 2006). Based on research on the correlation of blood clam size with mercury (Hg) heavy metal concentrations by Fauziah, A R, Rahardja, B S and Cahyoko, Y in 2012 in the Ketingan river estuary, Sidoarjo, East Java, the conclusion of blood clams (*Anadara granosa*) of large size (≥ 2.5 cm) had higher mercury heavy metal concentrations (ranging from 0.037-0.047 mg/kg) than blood clams (*Anadara granosa*) of small size (< 2.5 cm) (ranging from 0.030-0.036 mg/kg).

Mercury (Hg) is a dangerous heavy metal that can cause both acute and chronic poisoning. In addition, mercury can be biomagnified in the human body, which causes mercury levels to multiply in the body even though it enters in small amounts. The limit of mercury content in eligible shellfish is regulated in SNI 7387:2009 below 1 ppm.

In addition to mercury content in turtle shells consumed as food, mercury also causes exposure to cosmetics industry workers. Prihartini and Hutagalung, 2018 stated that the cosmetics industry absorbs a lot of labor in Indonesia due to the needs of people who want to appear, mercury levels around 50100 $\mu\text{g}\%$ will show symptoms of poisoning. Health problems occur due to high mercury exposure in a short time are lung damage, vomiting, increased blood pressure and heart rate.

Heavy Metal Levels in Seawater

Based on the results of the study, the levels of heavy metals in the waters are presented in Figure. 5.

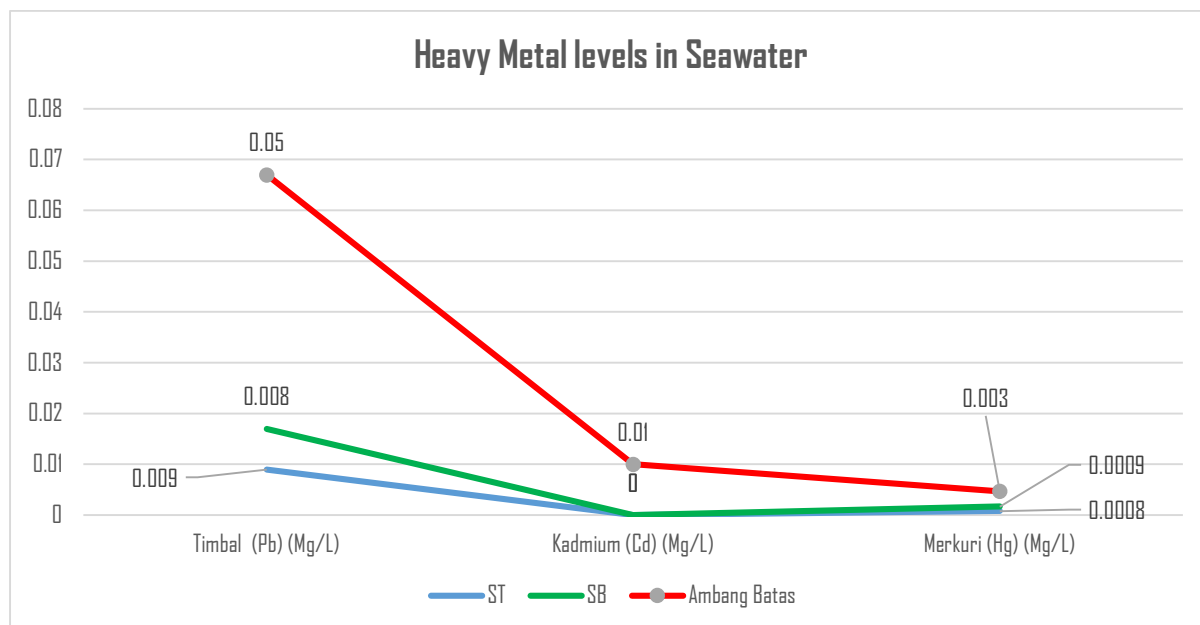


Figure 5. Heavy Metal Levels in Seawater

The levels of heavy metals Lead (Pb), Cadmium (Cd) and Mercury (Hg) in the waters of Kuala Jambi and Kuala Sumbur ranged from 0.0008 - 0.009 Mg/Kg which compared to the threshold of KEPMENLH Number 5 of 2014 is still in normal condition.

IV. CONCLUSION

The average content of heavy metals in blood clams in waters namely Lead (Pb) of 1.113 Mg/Kg, Cadmium (Cd) of 0.025 and Mercury 0.21 Mg/Kg exceeds the threshold set by the Quality Standard based on PPRI No.22 Year. The levels of heavy metals Lead (Pb), Cadmium (Cd) and Mercury (Hg) in the waters of Kuala Jambi and Kuala Sumbur ranged from 0.0008 - 0.009 Mg/Kg which compared to the threshold of KEPMENLH Number 5 of 2014 is still in normal condition.

V. SUGGESTIONS

Further research needs to be carried out on Bioaugmentation Studies to reduce Heavy Metal Concentrations found in blood clams (*Anadara granosa*), for the safety of blood clam consumption for humans.

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