

ANALYSIS OF THE HEAVY METAL CONTENT OF LEAD AND MERCURY IN FRESHWATER SEA SHELLS IN THE RIVER KRUENG SABEE ACEH JAYA

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Abstract

Gold mining in Aceh Jaya, specifically in Gunong Ujeun, results in the discharge of waste water containing heavy metals into nearby rivers. This can negatively impact the environment, particularly through contamination by lead and mercury. These heavy metals can be toxic to aquatic life, potentially disrupting the food chain. Kijing clams, a type of shellfish commonly found in freshwater rivers, are particularly susceptible to metal accumulation due to their filter feeding behavior. This research aims to assess the impact of lead and mercury levels in the Krueng Sabe river on the accumulation of these metals in shellfish, exceeding the threshold set for the river in Aceh Jaya Regency. The study will use Atomic Absorption spectroscopy (AAS) to measure the heavy metal content. The results show that the lead content in shellfish meat is 0.191 mg/kg, while the mercury content is 0.255 mg/kg. These levels are below the maximum limits set for heavy metals in food.

Keywords: Lead, Mercury, Seashells

1. INTRODUCTION

Heavy metals are pollutants that are very dangerous for environmental systems because they are toxic, cannot be decomposed naturally and tend to accumulate in the waters and bodies of organisms (Gu et al., 2018). Heavy metals that often pollute the environment such as cadmium (Cd), arsenic (As), copper (Cu), mercury (Hg) and lead (Pb). Mercury and Lead are heavy metals that are harmful to aquatic ecosystems and humans. Accumulation of heavy metals in humans causes impaired brain, liver, kidney, lung, and muscle function (Arantes et al., 2016).

Lead (Pb) metal enters the water naturally by crystallizing lead (Pb) in the air with the help of rainwater. The high level of human activity has a major role in heavy metal contamination of the environment. The presence of lead in the environment at high concentrations can have an impact on human health (Nur, 2017).

Metal mercury (Hg) is often a problem that tends to occur in gold mining areas, which can cause health problems for the local community (Lestaris, 2010). The presence of mercury in the environment can come from various human activities that produce mercury waste so that the concentration of mercury in the environment can increase (Purnawan et al., 2013). Heavy metal mercury is commonly found in polluted river water due to gold mining waste disposal.

Gold mining in Aceh Jaya is located in Gunong Ujeun where water from gold mining waste is discharged into several rivers. There are several rivers that drain into Aceh Jaya Regency, one of which is the Krueng Sabe river. According to previous

research, there are several who have conducted research in the Krung Sabe river. One of them was conducted by Putra et al (2021) there were 3 samples obtained from 3 different places showing mixed results. The lowest mercury content found in the Upstream location (Geuni Village) was 0.265 pbb. While the highest was found in the Median location (Ranto Panjang Village) 0.551 pbb. This shows that there is mercury metal content in Krueng Sabe river water.

Heavy metals dissolved in water bodies at certain concentrations will turn into a source of poison for aquatic life. Although the toxic power caused by one heavy metal to all aquatic biota is not the same, the loss of a certain group of organisms can make a break in the chain of life. At an advanced level, this situation can certainly destroy an aquatic ecosystem order. Many aquatic organisms such as fish, shrimp, clams and crabs are contaminated with heavy metal concentrations from water and sediments (Bulolo, 2022).

One of the aquatic organisms that absorbs metal sediments is mussels. Mussel (*Pilsbryconcha exilis*) is one type of mussel that is widely found in freshwater river waters. The abundant population of mussels and the nutritional content of mussels that are good for health encourage people to make mussels as an affordable and easily available source of animal protein. Mussels can accumulate metals more than other aquatic animals because they are sedentary and filter feeders and are slow to escape the effects of pollution. Therefore, mussels are excellent biological indicators to monitor metal pollution in the aquatic environment (Darmono & Hidup, 2001)

Based on the background of the problems presented, the problem formulation is the Analysis of the Content of Heavy Metal Elements of Lead and Mercury in Freshwater Mussel Shells in the Krueng Sabe River Aceh Jaya. The purpose of this study was to determine how the effect of lead and mercury content in Krueng Sabe river water on increasing lead and mercury levels in shellfish that exceed the threshold in the Krueng Sabe river, Aceh Jaya Regency.

2. RESEARCH METHOD

This research method is an experimental method which is part of a quantitative method, in the form of a survey using a cross sectional survey design and laboratory tests. Determination of mussel samples using purposive sampling method. Purposive sampling is a data source sampling technique with certain considerations. The shellfish samples taken were mussel shells.

To obtain samples, a survey was conducted to shellfish traders in the Panga Aceh Jaya area. Samples were obtained from traders who sell mussel shells. Based on the results of interviews with mussel traders in the Panga area, it is known that the mussels sold in the region come from the Krueng Sabe River, Aceh Jaya Regency.

2.1. Time and Research Location

The research sampling time was carried out on October 25, 2023, then the samples were taken to the Environmental Quality Testing Technology Laboratory (LTPKL) on October 26 to November 26, 2023. This research was conducted in the Krueng Sabe river area, Aceh Jaya Regency, Aceh Province.

2.2. Sampling Stages

As for the stages or process of sampling before finally being taken to the laboratory, the shells that have met the research criteria are then dissected/separated from the shell, then taken to the Environmental Quality Testing Technician Laboratory (LTPKL) for further testing.

The final stage is that the shells are weighed as much as 20 grams and added 20 ml of 1: 1 nitric acid solution. Furthermore, it was deconstructed using a microwave. The test that has been deconstructed is then transferred into a 50 mL volumetric flask, add mineral-free water until the exact mark and homogenized. Then analyzed using Atomic Absorption spectroscopy (AAS).

3. RESULT AND DISCUSSION

The test results of mercury (Hg) levels in the research samples based on the Technical Laboratory for Environmental Quality Testing (LTPKL), can be seen in the following table:

Table 1. Results at the Technical Laboratory for Environmental Quality (LTPKL)

No	Test Parameters	Unit	Quality Standard	Analysis Result	Methods
1	Lead (pb)	Mg/L	1,5	0,191	AAS
2	Mercury (Hg)	Mg/L	1,0	0,255	AAS

Source: Environmental Quality Testing Technology Laboratory:2023

The results of the study of the content of lead (Pb) and mercury (Hg) in clam meat obtained from the Krueng Sabe River are obtained in the results of lead (Pb) 0.191 mg / kg. While in mercury (Hg) the result obtained is 0.255 mg/kg. When referring to Indonesia (2009) regarding the maximum limit of heavy metals in food, the allowable level in the body of shellfish biota is lead (Pb) of 1.5 mg / kg while the mercury (Hg) limit is 1.0 mg / kg.

The results of the analysis obtained show that it is still below the permissible threshold, but still need to be aware because of the nature of heavy metals that can accumulate in the body, so that if consuming marine biota containing lead and mercury continuously can affect the health of the human body.

This research is in line with Lensoni et al (2020) on the effect of mercury in Krueng Sabe river water on increasing mercury levels in fish, langkitan and shellfish in the Krueng Sabe river using the AAS method, which obtained the results of mercury in shellfish was 0.0522 mg / kg.

In the research of Titik, et al 2022 on the analysis of heavy metals cadmium and lead in shellfish circulating in Paotere Fish Auction Makassar City with the AAS method is not in line because the result of lead metal in shellfish is 5.9 mg / kg which exceeds the maximum threshold of quality standards that have been set.

This is because the Paotere Fish Auction area of Makassar City has many activities of fishing boats in the waters of the fish auction site, causing waste or disposal products from ships to cause water pollution, in addition to ship passengers or the public who throw their garbage in the waters and ships that experience paint peeling due to the age of the ship.

4. CONCLUSION

Based on the results of the study, it was found that the heavy metal content of lead (Pb) was 0.191 and heavy metal mercury (Hg) was 0.255 which based on SNI No.7387 regulations is still below the threshold limit in food, namely lead (Pb) of 1.5 mg / kg while the mercury (Hg) limit is 1.0 mg / kg.

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