Analysis of lead (Pb) heavy metal content in Layang fish *(Decapterrus ruselli)* in KUD Gabion Belawan, Medan City

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**Abstract.** The many industrial activities around Belawan waters do not rule out the possibility of producing solid and liquid waste that can cause water pollution. One of the most worrying pollution in Belawan waters at present is heavy metal pollution such as lead (Pb) which can accumulate in the flesh of laying fish *(Decapterrus ruselli)*. Layang fish *(D. ruselli)* is a popular fish that is often consumed by humans because it has a relatively affordable sale value for all economic groups of the community. This study aims to determine the average value of the heavy metal content of lead (Pb) contained in the layang fish meat *(D. ruselli)* and the level of consumption eligibility. The result of this study indicates the average value of lead (Pb) metal in layang fish *(D. ruselli)* in KUD Gabion Belawan, Medan City is 0.035-0.054 mg/kg. Overall, layang fish *(D. ruselli)* contaminated with lead (Pb) heavy metals are still within the safe limit for consumption, following the maximum limit of heavy metals issued by the Indonesian National Standard (SNI).

**1. Introduction**

Belawan waters are areas that have high fish resource exploitation and are used intensively by conventional and modern fishermen. These waters are also known as one of the territorial waters with large commercial ship traffic because of their function as an international trade channel. The large number of industrial activities around this water area produces solid and liquid waste that can cause water pollution. One of the polluting wastes that are quite alarming in Belawan waters at present is the presence of heavy metal such as lead (Pb) [9].

Lead (Pb) is one of the most widely used heavy metals in industrial activities such as the textile, paint, fuel oil, pharmaceutical, pesticide and detergent industries. Lead (Pb) is the most common type of heavy metal found in nature, both in natural processes such as rain and wind damage, the aging process and volcanoes [3].

Increasing the content of heavy metals in an area of water is continuously known to endanger the existence of organism that live in it, one of which is fish. High levels of heavy metals contained in the body of aquatic organism can be used as indicator of the level pollution of the aquatic environment.

The existence of heavy metals such as lead (Pb) in the waters will be difficult to degrade even heavy metals will tend to be absorbed into the body of the organisms that live in them even though the types of heavy metals such as lead (Pb) are known as dangerous heavy metals that can cause acute and chronic poisoning. [2] states there are several ways of entry of heavy metal in the bodies of fish such as through the skin, respiratory tract and also through the digestive tract.
Layang fish (*Decapterus russelli*) is one type of fish resource that is often caught around Belawan waters. This fish is a type of small pelagic fish that is often consumed by people because of its high protein content and has a relatively affordable sale value for all groups. However, if heavy metals contaminate this fish and then consumed continuously it will be harmful to human health and cause poisoning to the human body [5].

Based on this description, it is necessary to conduct research on the content of heavy metals, especially lead (Pb) heavy metals in layang fish (*D. russelli*), which are marketed at the KUD Gabion Belawan, Medan City.

### 2. Material and method

This research was conducted in May-June 2019. Fish samples were taken at the fish market KUD Belawan Gabion, Medan City. Whereas the Lead (Pb) analysis was conducted at the Fish Quarantine Quality Control and Safety Fisheries (BKIPM) Laboratory Medan I, Medan City.

#### 2.1. Tools and materials

The tools used in the study include, 25 ml beaker cups, 100 ml beaker cups and 250 ml beaker cups, 25 ml and 50 ml beaker cups, hot plates, 50 ml and 1000 ml measuring flasks, blenders, polypropylene bottles, porcelain cups, micropipettes, volumetric pipettes, knives, refrigerators or freezers, spatulas, Atomic Absorption Spectrum Z-Xpresss8000, styrofoam, analytical balance with an accuracy of 0.0001 g, furnaces, polystyrene containers, stationery and digital cameras. While the main ingredient used is layang fish (*Decapterus russelli*). Other ingredients are 37% HCL, 65% HNO3, Aquadest standard, and Lead (Pb).

#### 2.2. Research procedure

Fresh fish samples from Belawan waters marketed at KUD Belawan Gabion, Medan city. The first sample was taken on May 13, 2019 and the second sample was taken on June 13, 2019. Put the sample in the styrofoam box and taken to the Fish Quarantine Laboratory of Fishery Product Quality and Safety Control (BKIPM) Medan I, Medan city. Code each sample and calculate the total weight (kg) and length (cm) for supporting data.

In the laboratory, crush each sample using a blender until the sample is smooth and then put the sample in a 50 ml polystyrene container. Weighed 5 grams of refined sample. Put the sample into the furnace. Set the furnace temperature for 30 minutes. The furnace temperature is gradually increased by 100°C every 30 minute to reach 450°C for 18 hours. Cool the sample at room temperature. A few drops of H2O and 1 ml of 65% HNO3 were added after it cooled. Heated on a hot plate at 100°C to dry. Reinsert the sample into the furnace at a temperature of 450°C and the maintained for 2 hours 5 M HCL was added 5 ml after the ash was completely formed. Heated on a hot plate at 100°C until dry. Added 10 ml of 0.1 M HNO3 and chill at room temperature for 1 hour. Dissolve the sample in 50 ml polystyrene and then test it using the Z-Xresss8000 Atomic Absorption Spectrum device.

#### 2.3. Data analysis

In testing the lead metal content (Pb) in the flesh of a layang fish (*Decapterus russelli*), it was carried out using an atomic absorption spectrophotometer based on [9].

The calibration curve reading on the AAS tool can use the following formula:

\[
\text{Concentration } \text{Pb} \mu g/g = \frac{(D-E)_{xP_r}V}{W}
\]

Information:
- \(D\): sample concentration mg /l
- \(E\): blank sample concentration mg /l
- \(F_p\): dilution factor
V : the final volume of the prepared sample solution (ml)
W : sample weight (g)

3. Result and discussion
From the research conducted at KUD Belawan Gabion, Medan, the results of heavy metal lead (Pb) testing on layang fish (Decapterus russelli) in May using AAS tools using the furnace graph method as in Table 1.

Table 1. Concentration of heavy metal lead (Pb) in layang Fish (Decapterus russelli) in May

| No | Sample Code | Fish Length (Cm) | Sample Weight (g) | Absorbance | Conc. 1 (µg/L) | Conc. 2 (mg/kg) | Information |
|----|-------------|-----------------|-------------------|------------|---------------|----------------|-------------|
| 1  | CRM         | -               | -                 | 0.0122     | 1.674         | 0.399          | 0.404±0.062 |
| 2  | Fish 1      | 21.5            | 5.0090            | 0.0332     | 5.501         | 0.054          | -           |
| 3  | Fish 2      | 18.5            | 5.0044            | 0.0282     | 4.584         | 0.045          | -           |
| 4  | Fish 3      | 20.0            | 5.0053            | 0.0247     | 3.950         | 0.039          | -           |
| 5  | Fish 4      | 18.0            | 5.0050            | 0.0274     | 4.437         | 0.044          | -           |
| 6  | Fish 5      | 20.3            | 5.0044            | 0.0240     | 3.831         | 0.038          | -           |
| 7  | Fish 6      | 19.8            | 5.0024            | 0.0263     | 4.245         | 0.042          | -           |

Information : CRM (Certificate Reference Material)

From table 1 it can be seen that the value of the heavy metal lead (Pb) in layang fish meat obtained from KUD Gabion Belawan, Medan city is very volatile.

Table 2. Concentration of heavy metal lead (Pb) in layang fish (Decapterus russelli) in June

| No | Sample Code | Fish Length (Cm) | Sample Weight (g) | Absorbance | Conc. 1 (µg/L) | Conc. 2 (mg/kg) | Information |
|----|-------------|-----------------|-------------------|------------|---------------|----------------|-------------|
| 1  | CRM         | -               | -                 | 0.0122     | 1.683         | 0.401          | 0.404±0.062 |
| 2  | Fish 1      | 19.5            | 5.0061            | 0.0259     | 4.176         | 0.041          | -           |
| 3  | Fish 2      | 19.2            | 5.0074            | 0.0237     | 3.769         | 0.037          | -           |
| 4  | Fish 3      | 18.0            | 5.0079            | 0.0224     | 3.545         | 0.035          | -           |
| 5  | Fish 4      | 18.5            | 5.0091            | 0.0246     | 3.932         | 0.039          | -           |
| 6  | Fish 5      | 18.8            | 5.0097            | 0.0251     | 4.033         | 0.040          | -           |
| 7  | Fish 6      | 18.3            | 5.0091            | 0.0230     | 3.639         | 0.036          | -           |

Information : CRM (Certificate Reference Material)

In this study there were six wet samples to analyse. The six samples are fresh layang fish (D. Russelli). The sample needed for preparation is 5 grams. Preparations are made using the wet crushing method. This method was chosen because wet crushing in general can be used to determine elements with low concentrations.

In this study, the test sample used was elevated laying fish (D. russelli). Meat is a part of body tissue in fish which is believed to be one of the places to attach heavy metals into the fish's body as stated by [8] that the level of accumulation of heavy metals in fish bodies from large to small is found in the liver, kidneys, gills and meat.

From the results of lead metal testing (Pb) in Figure 1 obtained shows that the highest levels of lead (Pb) metal are found in the first fish (D. russelli) taking with fish sample code 1 which is equal to 0.054 mg/kg. The lowest metal content of lead (Pb) is found in layang fish (D. russelli) with a sample code of fish 5 that is equal to 0.038 mg/kg. From the result of Lead (Pb) metal testing in Figure 2...
obtained shows that the highest levels of lead (Pb) metal are found in the second fish (*D. russelli*) taking with the sample code of fish 1 which is equal to 0.041 mg / kg and the content of lead (Pb) metal content is lowest in layang fish (*D. russelli*) with a sample code of fish 3 that is equal to 0.035 mg / kg.

![Figure 1](image1.png)

**Figure 1.** Graph of lead (Pb) heavy metal concentration in layang fish (*Decapterus russelli*) in May

![Figure 2](image2.png)

**Figure 2.** Graph of lead (Pb) heavy metal concentration in layang fish (*Decapterus russelli*) in June

Based on the results of measurements of heavy metal lead (Pb) levels in layang fish in the (KUD) Gabion, Belawan, Medan City, for the first and second pickings are shown in Figure 5 and Figure 6 shows that the value of lead (Pb) metal content for the whole samples – each ranged between 0.038-0.054 mg / kg and 0.035-0.041 mg / kg. The value of lead (Pb) metal content obtained is still below the quality standard value determined by [1] concerning the maximum limit of heavy metal pollution in food (fish and its processed products) that is equal to 0.3 mg / kg so that it can be said that fish the flight is still safe or suitable for consumption.

The entry of lead (Pb) metal into the body of the fish can be sourced from food or water environment that is polluted by heavy metals from human activities on land or in waters, which causes fish to be contaminated.

The low value of lead (Pb) metal content obtained from the test results of all layang fish samples (*D. Ruselli*) is suspected because the fish were caught during the transition season (transition) from the rainy season to the dry season, where the direction of the wind is irregular and frequent heavy rains suddenly. Prasetyo et al (2017) states that high rainfall intensity can affect the rate of decay of heavy
metals in waters so that they can cause heavy metal decay both in water and in fish bodies. The decay process produces heavy metal lead (Pb) which is low in water and fish.

Fish is one of the aquatic biota that can accumulate heavy metals in these water. According to [6], the heavy metal content in fish is closely related to the disposal of industrial waste around fish lie, such as rivers, lakes, and seas. The amount of heavy metals found in fish depends on the amount of heavy metals in the aquatic environment and also the ability of fish to absorb and accumulate metals.

The presence of lead (Pb) metal content in the body of layang fish (D. russelli) is suspected due to the condition of the aquatic environment that is polluted by waste from industrial activities and household activities around the waters area. The presence of waste in these waters will then accumulate in the body of the layang fish through its food chain. According to [7] entry of lead (Pb) metal into the waters through the process of settling originating from activities on land such as industry, household and erosion, falling particles from the combustion process containing tetraethyl Pb, wastewater from tin ore mining black and discarded the rest of the battery industry.

Based on the results of tests conducted in this study, it is known that overall the highest lead (Pb) metal value is always found in larger fish. This is possible because the ability of layang fish to absorb or accumulate heavy metals depends on the size of the fish and the types of metals present in the waters, the larger the size of the fish results in the ability of the fish to absorb and accumulate heavy metals. higher metal. [8] which states that the ability of marine biota (fish, shrimp and mollusks) to accumulate heavy metals in waters depends on the type of heavy metal, type of biota, duration of exposure and environmental conditions such as pH, temperature and salinity. The greater the size of aquatic biota, the accumulation of heavy metals will increase.

4. Conclusions

The conclusion of this study is the value of lead (Pb) metal content in fish meat (Decapterus russelli) in KUD Gabion Belawan, Medan, which was investigated ranged from 0.035-0.054 mg / kg and lead (Pb) metal content in the flesh of flying fish (Decapterus russelli ) in KUD Gabion Belawan, Medan City which has been investigated is still below the maximum limit of heavy metals determined by [1] regarding heavy metal contamination in food (fish and processed products).

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