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ANALYSIS OF THE HEAVY METAL CHROMIUM (Cr) IN MULLETS *(Mugil dussumieri)* SPECIES IN THE WAI RUHU GALALA RIVER AMBON CITY

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ABSTRACT

The heavy metal chromium (Cr) is one of the heavy metals which is toxic and h armful if it accumulates in the body of organisms at high concentrations. Heavy metals can accumulate through the food chain, namely the higher the level of the food chain occupied by an organism, the accumulation of heavy metals in the body also increases. The aim of the research was to determine the liver contamination of mullet exposed to chromanum metal. The method used in this study was the purposive sampling method. Sediment and mullet at the Basic Kimia FKIP Laboratory while to measure the content of heavy metal Cr in sediment and mullet at the Karpan Health Laboratory, Ambon 11 Desember 2022 - 18 Januari 2023 using the AAS (*Atomic Absorption Spectrophotometer*). The Cr content in the sediment and mullet obtained at the estuary of the Wai Ruhu Galala river, Ambon City is still below a predetermined threshold. The research results obtained from the content of heavy metal cr in the sediment which is equal to 9,2888 Ppb while in mullet it is equal to 5,8185 Ppb. The presence of heavy metal cr is caused by contaminants which may originate from community activities around this location in the form of housedold waste coated with cr metal discharged directly into the water body such as household appliaces coated with cr metal and cans paint.

Keywords: *accumulation, mullet fish, chromium, sedimen*

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INTRODUCTION

Ambon City is river pollution in recent years has become one of the most serious problems encountered in the field. The input of pollutant into the river resulted in a decrease in water quality. The incoming pollutants come from the disposal of waste from domestic activities which will result in increased pollution in rivers, especially at river estuaries. The Wai Ruhu river estuary is a river estuary that is included in the Ambon city area. The Wai Ruhu river estuary crosses the Galala Village area of Ambon City, where this river estuary has become a place for community activities such as fishing and netting fish for consumption and also as an alternative place for disposing of rubbish. The increasing number of settlements from year to year in this estuary with a fixed land area has resulted in increasingly heavy pressure on the environment. Various human activities to meet the needs of life originating from industrial and household activities will produce waste which has an impact on reducing the quality of water in rivers. The behavior of communities and industries that directly dispose of their waste into rivers may contain metals such as chromium (Cr) which can harm health. The presence of these metals, even in small levels, will endanger the health of consumers and remember that heavy metals will accumulate in the body, so that gradually the levels will increase and be very dangerous to health. Around the Wai Ruhu river estuary area, there are no specific industries or factories that can cause water pollution, but people around the Wai Ruhu river estuary usually throw household waste (detergent) directly into the water.

Chromium metal can enter waters naturally through several physical factors, such as the process of erosion of mineral rocks from water catchment areas around rivers, while the entry of Chromium into waters occurs non-naturally, namely as an impact or effect of human activities, including waste. such as detergent soap and other consumer products (Hidayah, Purwanto, & Soeprobowati (2014). Taftazani (2007) states that sources of chromium related to human activities can be waste or household waste. Mullet fish (Mugil dussumieri) is one of the organisms that lives in the Wai Ruhu river estuary and is one type of fish consumed by the local community. Fish as one of the aquatic biota can be used as an indicator of the level of pollution that occurs in the waters. The mullet food consists of small algae, diatoms, zooplankton and detritus in the sand and silt. The way to eat mullet fish is also by filtering the water and absorbing the detritus in the mud so that the fish is very easily contaminated by heavy metals found in the water and sediment. Mullet fish is a fish that is often consumed by local people, therefore it is necessary to know the safe limits for consuming mullet fish for people around the mouth of the Wai Ruhu river. So far, the presence of mullet fish caught around the mouth of the Wai Ruhu river has never been known how much heavy metal content their bodies are exposed to. However, if the fish is contaminated with heavy metals and is consumed continuously, it could potentially be dangerous to the health of the people who consume it. These heavy metals can accumulate in fish organs such as meat or muscles and the liver of river biota in two ways, namely the food tract and the surface of the gills.

Based on this, it is necessary to carry out research to determine the content of the heavy metal Cr in mullet fish obtained at the mouth of the Wai Ruhu river. These levels are compared with the maximum limit for the heavy metal Cr, which is 1 mg/kg according to the Food and Drugs Administration. By analyzing the levels of the heavy metal Cr in fish, it is hoped that in the future monitoring will continue to be carried out to find out how much Cr metal content is in mullet fish, so that it does not exceed the specified maximum limit, so that the quality and safety of food, especially fish, can be maintained.

METHOD

Material

Sulfuric acid, nitric acid, hydrochloric acid, distilled water, standard Cr solution concentration of 10000 ppb, mullet and sediment.

Tool

Electric balance, microware, oven, hot plate, measuring flask, beaker, centrifuge, stir bar, digital scale, PVC pipe, plastic sample, net, sample paper.

Preparation

Researchers make observations at the research location to determine the sampling point and sample collection time, which will then be tested in the laboratory.

Retrieval

Sampling was carried out at 2 point at the estuary of the wai ruhu river, the technique used was purposive sampling. Sediment samples were taken using pipes and plastic samples while mullet samples were taked used nets and plastic samples. The distance for taked sediment samples from the edge of the river estuary is 1 meter from the edge of the river estuary with a depth of 7.5 cm, while the distance for sampling mullet fish from the edge of the river estuary is 5 meters with a depth of ± 15 cm.

Sample Preparation

1. Samples before digestion must be dried until they are free of water and refined first.
2. The dry sample is weighed 1-2 grams in an Erlenmeyer, add 1 ml of concentrated sulfuric acid and 15 ml of concentrated nitrate and leave overnight. Then add 45 ml of hydrochloric acid and heat at 60-70°C until the brown gas has completely evaporated.
3. Warm up at 100°C until the solution evaporates. Then the solution is cooled until it reaches room temperature, add enough aquabides and filter with filter paper and rinse 2-3 times with 10ml of aquabides.
4. The filtering results are transferred into a 100ml measuring flask, add aquabides until it reaches the limit mark and the solution is stirred until homogeneous.
5. The prepared samples were measured for Cr content using AAS (Atomic Absorption Spectrophometer). Wavelength 357.9 nm (Prastyo, Deny et al. 2016). Then it is intrapolated into the standard calibration curve of each element to obtain the regression concentration of each element.

DISCUSSION RESULT

The samples observed were sediment and mullet fish at the mouth of the Wai Ruhu Galala river, Ambon City which were taken from 11 December 2022 to 18 January 2023. Sediment and mullet samples were taken from 2 different points, namely sediment samples taken at a distance of 330 m from sea level while mullet samples were taken at a distance of 200 m from sea level. Sediment samples were taken at low tide using PVC pipes and plastic samples that had been labeled at a distance of 1 meter from the edge of the river mouth

with a depth of 7.5 cm while mullet samples were netted at a depth of ±15cm below the surface of the river mouth. The size of the mullet includes 15.5 cm. The fish obtained from the catch are then cleaned first to take the liver and weigh 69.135 gr. Mullet and sediment samples were destructed with HNO3 at the Basic Chemistry Laboratory of FKIP Pattimura because of its high acidity and very strong oxidizing properties. Furthermore, the sample that has been added with solvent is then heated to speed up the process of decomposing organic compounds so that it will produce free inorganic materials. Complete digestion is indicated by obtaining a clear solution in the digestion solution which indicates that all the constituents present have completely dissolved or the decomposition of organic compounds has gone well. The two results of the digestion were then analyzed using an atomic absorption spectrophotometer with a wavelength of 357.9 nm at the Karpan Health Laboratory, Ambon.

Chromium Standard Curve

The standard curve is a curve that shows the relationship between the concentration of the new Cr series and the response of the instrument in the form of absorbance. The linearity of a method is indicated by the magnitude of the correlation coefficient (r) of the standard curve. Cr metal is made with 12 concentration ranges, namely 0.000; 1,000; 2,000; 3,000; 4,000; 5,000; 6,000; 7,000; 8,000; 9,000; 10,000; 11,000 and 12;000 ppb.

The absorption measurement results are then plotted to obtain the standard curve and the equation of the linear line. The standard curve is made with the linear regression equation, namely y = ax ± b, where y is the absorbance while a and b are constants which will be determined by the slope value. Comparison between the absorbance value and the standard solution will produce a straight line curve. The data obtained is then made a calibration curve by comparing the concentration of the standard solution (x) to the absorbance (y), so that the equation of the linear regression line can be determined. The standard curve for Cr metal can be shown in Figure 1

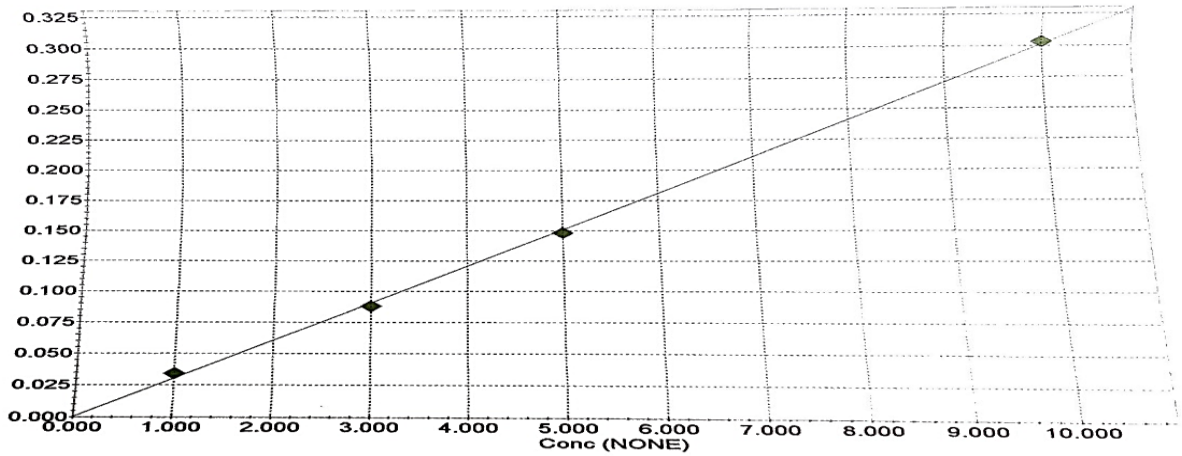

Figure 1. Cr Metal Standard Curve

Based on the curve image, the best correlation coefficient (r) was chosen because it has a linear relationship between increasing concentration and instrument response. According to Miller (2010), a good r value is > 0.99, which means the analysis method meets the linearity requirements. The figure shows that the equation y = 0.030112 x+ 0.0029162, r = 0.9996 has a good correlation coefficient, so it was selected and can be used as a basis for calculating levels.

Table 1. Results of Cr Concentration in Mullet Fish and Sediment

Sample ID	Abs.	VOL	Actual Conc.
Fish liver 20x	0.1755	10	5.8185
fine sand sediments 20x	0.2800	20	9.2888

Based on the results of examining the heavy metal content using AAS in the liver of mullet fish at the mouth of the Wai Ruhu River, Ambon City, the heavy metal content Cr was 5.8185 Ppb, while in the sediment it was 9.2888 Ppb.

Metal Chromium (Cr) in Sediments at the Wai Ruhu Galala River Estuary, Ambon City

Analysis of the Atomic Absorption Spectrophotometer at the Karpan Ambon Health Laboratory shows that the level of chromium metal (Cr) in sediments at the mouth of the Wai Ruhu Galala river, Ambon City,

is still below the threshold when compared to the Australian and New Zeland Environment and Conservation Council's (ANZECC) guidelines. The content of chromium metal (Cr) in the sediment at the estuary of the Wai Ruhu river is higher than the heavy metal content found in mullets. This is because the heavy metal chromium has properties that easily bind organic matter and tends to settle to the bottom of the waters and then blends with the sediment so that the heavy metal content in the sediment is higher than that of water or fish. Sediment is a collection of the breakdown of surrounding rocks that will have a heavy metal content determined by the mineralogy of the original rock. In areas affected by human activities, the heavy metal content recorded in sediments will consist of natural geochemistry plus human activity results. This condition means that the input of heavy metal contaminants still tends to come from land (Zainal A., 2009). Sediment size also affects the heavy metal content in the sediment. Sediment that has a finer particle size will be followed by an increase in the amount of inorganic and organic matter where the finer the sediment size, the greater the ability to accumulate inorganic and organic matter (Maskulah, 2013).

Based on the results of observations in the Karpan Health Laboratory in sediment, it was obtained that it was 9.2888 Ppb or 0.092888 mg/kg. In general, the sediment content is higher than that found in the water column. This is because the heavy metal content is affected by gravity (Adhani and Husaini, 2017) and has properties that are easily bound by sediment so that it tends to settle (Purwaningsih et al., 2015). The characteristic of the metal element Cr is that it dissolves more easily in water. Physical influences such as currents, tides, up welling, and waves can cause the sediment to stir up so that the levels of heavy metals in the sediment are also lifted. It is different from the results of observations of Cr metal content in sediments in deep Ambon bay waters (Batu, et al 2019). The highest Cr metal content was found in Poka Village, namely 191.74 mg/kg. The high level of Cr metal is probably caused by a current pattern that develops where this location is in the bay and is an estuary so that chromium metal (Cr) that enters or is carried from other locations will be stuck at this location and when the water recedes it will lead to the outside of the river mouth. while at high tide it will lead into the mouth of the river, causing contaminants in other locations to enter and increase the presence of Chromium (Cr) metal at this location. Thus it can be seen that the sediment conditions in the estuary of the Wai Ruhu Galala river, Ambon City, are not polluted by Cr metal based on observations that can be compared with the quality standards issued by ANZECC (Australian and New Zeland Environment and Conservation Council) which have been revised in in 2000, namely 80–120 mg/kg, only a small amount of contamination occurred in the sediment at the mouth of the Wai Ruhu Galala river, Ambon City. It was concluded that the content of heavy metal chromium (Cr) in sediments in the estuary of the Wai Ruhu Galala river, Ambon City, is still in the safe category for life because the lack of industrial and domestic activities around the observation area resulted in a minimum content of Cr metal in sediments.

Heavy Metal Chromium (Cr) in Mullet Fish *(Mugil dussumieri)* at the Wai Ruhu Galala River Estuary, Ambon City

The results of heavy metal chromium (Cr) in sediments is still below the threshold, similarly the content of heavy metal Cr in mullet is also below the threshold if it is based on a Food and Drug Administration (FDA) regulation and a decree issued by (BPOM) Food and Drug Monitoring Agency. Heavy metals include chromium (Cr), a metal that has high toxic power. If this heavy metal continues to accumulate in the human body through food, it will result in poisoning. Based on the results of the study in table 4.1, it shows that the heavy metal content of Chromium (Cr) in mullets has a lower content when compared to the heavy metal content in sediments. The results of the Karpan Health Laboratory examination found that the heavy metal Chromium (Cr) content in mullet in the estuary of the Wai Ruhu river was 5.8185 Ppb or 0.058185 mg/kg. The heavy metal Chromium (Cr) detected in the liver of mullet in the estuary of the Wai Ruhu river is caused by several factors, including the presence of contaminants in the fish's habitat. The content of Chromium (Cr) metal is likely to originate from community activities around this location in the form of household waste coated with Chromium (Cr) metal which is discharged directly into water bodies such as household appliances coated with Cr metal and cans paint. Remains of paint or paint spills both from houses and from boats found around this location also add to the levels of heavy metal Chromium (Cr) in the Wai Ruhu river estuary, because Chromium (Cr) metal is widely used as a coating material and also as a dyes in paint (Palar, 1994; 2008).This is different from the results of a study by Prastyo, et al (2016), where the types of snakehead fish caught are generally below the predetermined threshold, except for the gills and liver of snakehead fish which are 443 mg/kg and 2.37 mg/kg. , where the levels have exceeded the specified threshold.

Fish are one of the aquatic organisms that directly receive the impact of pollution in the waters. Even though fish is a food ingredient for humans (Oktaviatun 2004). The impact that occurs when you have been poisoned by the heavy metal chromium (Cr) such as nausea, stomach ache, respiratory problems, a weak immune system, kidney and liver damage, lung cancer and if it accumulates continuously can result in death. The accumulation of large amounts of chromium (Cr) in the body can harm health. According to Rochyatun and Rozak (2007) that aquatic biota that live in waters polluted with heavy metals can accumulate these

heavy metals into their body tissues, the higher the heavy metal content that accumulates in the animal's body. Through the food chain, chromium is deposited in the body parts of living creatures which at certain sizes can cause poison (Mulyani 2004). When compared with the standard standard for heavy metal chromium (Cr) in fish according to the Food and Drug Administration regulations regarding heavy metal contamination in food, the maximum permitted level of Cr metal is 1 mg/kg, while based on BPOM provisions, the permitted amount is 2.5 mg/kg. . So the content of heavy metal chromium (Cr) in mullets in the estuary of the Wai Ruhu Galala river, Ambon City, is still below the safe limit for human consumption. Even though the content of the heavy metal chromium (Cr) in mullet fish is low, you need to be careful.

CONCLUSION

1. The results of research on the content of the heavy metal Chromium (Cr) in sediment obtained at the mouth of the Wai Ruhu Galala river, Ambon City was 9.2888 Ppb or 0.092888 mg/kg. These results indicate that the levels of the heavy metal chromium (Cr) in the sediment are still below the maximum limit for chromium metal contamination based on the Australian and New Zealand Environment and Conservation Council (ANZECC) regulations which were revised in 2000, namely 80–120 mg/kg.
2. The concentration of the heavy metal chromium (Cr) in mullet fish (Mugil dussumieri) obtained directly at the mouth of the Wai Ruhu Galala river, Ambon City was 5.8185 Ppb or 0.058185 mg/kg. These results are compared with the quality standards set by the (FDA) Food and Drugs Administration, where the maximum permitted level of chromium metal is 1 mg/kg and based on the provisions of the (BPOM) Food and Drug Supervisory Agency, the permitted level is 2.5 mg/kg. The mullet fish located at the mouth of the Wai Ruhu Galala river, Ambon City, is still in the safe category for consumption.

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