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IMPACT OF MERCURY (Hg) USE ON LAND AND WATER IN THE DISTRICT OF KAYELI BAY, BURU REGENCY

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ABSTRACT

Mercury or also called mercury (Hg) is one of the heavy metals that is very dangerous for human life. If there is high exposure to mercury it can cause damage to cells, respiratory tract, nervous system, kidneys and eventually death. Kayeli Bay District is a sub-district in Buru Regency, where there are several Dusun and Desa that carry out traditional gold mining activities with excessive use of heavy metal mercury. This research was conducted in Kayeli Bay District by taking water and soil samples in Anahoni Hamlet (Station I), Wayasel Hamlet (Station II) and Kayeli Village (station III). In this area gold mines and rivers are flowing from the Wayapo plains which have been contaminated with mercury from bald mountain gold mining. The results showed that the highest mercury content in the soil was found in Wayasel Hamlet (station II) which was 104.04 ugl / kg, while the highest mercury content in water was in Anahoni Hamlet (station I) which was 23.4 ugl / kg with heavy pollution category.

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INTRODUCTION

Mercury (Hg) is one type of heavy metal that is found in nature and is spread in rocks, ore, soil, water and air as organic and inorganic compounds. Various types of human activities that can cause high levels of mercury, for example mining Naturally, mercury pollution (Hg) is derived from groundwater

seepage activities that pass through the Hg deposit. When entering mercury waters it is easy to bind with chlorine in the HgCl (inorganic mercury) bond. This inorganic mercury (HgCl) will form HgCl. In this form, Hg can easily enter plankton and can move to other biota.

This HgCl will be transformed into organic mercury (Methyl mercury) by the role of microorganisms that occur in the bottom waters of sediments. Mercury can also be combined with carbon to form organomerkuri compounds, the most common of which is methyl mercury produced by microorganisms in water and soil. Against Hg with the first symptoms are paresthesia, ataxia, deafness and finally death.

High exposure to mercury can cause damage to the digestive tract, nervous system and kidneys. Also, mercury is at risk of disturbing various organs of the body, such as the brain, heart, kidneys, lungs to the immune system. Pregnant women who are exposed to mercury can cause defects in newborns. The results showed that the fetal brain was more susceptible to methyl mercury compared to the adult brain. Concentrations of 20 mg Hg in the blood of a pregnant woman can already damage the fetus.

Mercury has a high affinity for phosphate, cystine and histidine which are side chains of protein, purines, pyrimidines, peteridine and paifirin. In low concentrations Hg + ions can inhibit the performance of 50 enzymes that cause the body's metabolism is disrupted.

Inorganic mercury salts can cause protein precipitation, damage the digestive tract mucosa, damage the kidney membrane and the glomerular system membrane. Chronic poisoning by mercury can occur due to skin contact, food, drink and breathing. Chronic toxicity in the form of disorders of the digestive system and nervous system or gingivitis. Hg accumulation in the body can cause tremors, Parkinson's, gray eye lens disorders, and anemia. Followed by nervous system disorders that are very sensitive to the kidneys.

Mercury heavy metal or known as Hydragrum (Hg) is a chemical element in the form of liquid, silver white and volatile at room temperature of 7,640 atm. Mercury (Hg) has toxic properties in the body, even though its presence is only in low concentrations.

Worl Health Organitation (WHO), classifies Hg as the 10 list of chemicals that are most dangerous to the human body, because as ions or in the form of certain compounds easily absorbed into the body, bioaccumulation and biomagnification also occur that damage cells and tissues in the body.

Mercury can evaporate into the atmosphere when it rains, so it is contaminated with rainwater which is difficult to avoid. As a result of pollution, into the plant tissue, consumed by fish, biota, domestic animals and humans as consumers will also be affected.

Kayeli Bay Subdistrict is one of the Buru Subdistricts. There is a river flowing from the Wayapo Plain. The transmigration area of the rushed island, there is illegal gold mining on the bald mountain, which is discharged directly into the environment and the mercury content directly empties into the river, so that the river experiences pollution. This river flows directly into the hamlets and villages in the Kayeli Bay District.

If there is biomagnification and bioaccumulation in the body, various types of diseases will occur, namely cell damage, damage to genes, behavior, physiological forms of the body experiencing abnormalities and various other types of diseases, such as those that occur in minimata cases in Japan, cases in Minahasa and some other cases.

The purpose of this study is to determine the impact of the use of heavy metal mercury (Hg) on water quality, rivers and biota as well as macrozoobenthos diversity in Teluk Kayeli District, Buru Regency

Materials

Tools used: Vortex mixer, AAS, Analytical balance sheet, Hybrid generator, GPS, Digital camera, ice box, digestion pumpkin, tube. Materials used: Water samples, soil samples, NaCl, ice crystals. Reagents: Sodium brohibride solution, 5% concentrated HNO_3, 60% $HClO_4$, sharing paper, 5% $KMNO_4$ solution, NaOH, 5% Potassium Solution, 5% K_2S_2OP, NaCl-hydroxylamine sulfate, standard series solutions.

Table 1. Sampling Station

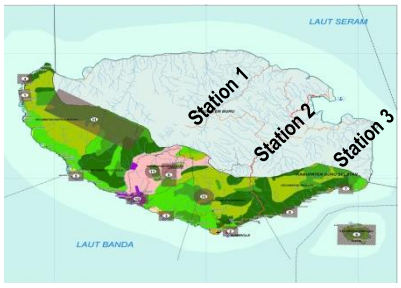
No	Location/Position	Area Description	Area Image
1	Station 1. Anahoni Hamlet	- Plain - river flow - plantation - trees	
2	Station 2. Wayasel Hamlet	- Plain - Plantation - Farm - trees	
3	Station 3. Kayeli Hamlet	- Plain - River - Coast	

Image 1.1. Map of Sampling Area

METHODS

A. Making a Standard Curve and Reading a Water Sample

1. Pipette 1 mL of 100 ppm Hg mother solution, put in a 100 mL measuring flask, set with distilled water to the mark (Hg: 1000 ppb)
2. Pipette 0.1 mL Hg 1000 ppb mother solution, put in a 10 mL measuring flask, set with aquadest to the limit of the mark (Hg: 10 ppb)
3. Create a standard concentration with a range (ppb): 0.05; 0.1; 0.2; 0.4; 0.8; 0.16; 3.2 by means of each pipette (mL) 0.05; 0.1; 0.2; 0.4; 0.8; 1,6; 3.2 enter it in vial
4. Read with a mercury analyzer

B. Water Sample Preparation

1. shake the sample, take 50 mL and put in a 125 mL Erlenmeyer
2. Plus 5 mL of HNO3
3. Heated on a hotplate until clear and white smoke comes out
4. Strain and match 100 mL with a measuring flask
5. Create blanks with the same treatment without samples
6. Take a sample, put it in a vial
7. Read with mercury analyzers
8. Calculate Total Hg with the formula:
   Total Hg (ppb) = ((Hg Read-Blank) x Final Volume x Fp) / (Sample Weight)

C. Sediment Sample Preparation

1. Weighed and put in a 100 mL Erlenmeyer Tube
2. Add 10 mL NHO_3: $HClO_4$ (1: 1)
3. Heated on a hotplate until clear and white smoke comes out
4. Strain and match 50 mL with a measuring flask
5. Create blanks with the same treatment without samples
6. Take the sample put in a vial tube
7. Read with Mercury Ananlyzer
8. Calculate Total Hg with the formula:
   Total Hg (ppb) = ((Hg Read-Blank) x Final Volume x Fp) / (Sample Weight)

RESULT

The results of the mercury (Hg) content found in soil and water in Amahoni, Wayasel and Kayeli Villages, Kayeli Bay District, Buru Regency can be explained as follows:

Table 2. The average mercury content in the soil in the villages of Anahoni, Wayasel and Kayeli Village, Teluk Kayeli District, Buru Regency.

No.	Code	Sample Weight	Final Volume	Hg Read (µg/Kg)	Final Hg (µg/Kg)	Hg on Average (µg/Kg)	Hg on Average (Mg/Kg)
1	Anahoni	1.1781	50	475,943	22,610	23,333	23
2	Wayasel	1.0640	50	2,228,966.67	104,240.58	113,552.99	104.24

3	Kayeli	1.0894	50	46,842	2,138	2,138	2

Based on table 2. above can be explained that the mercury content in the soil at (station I), namely Anahoni Hamlet, Hg average of 23,333 µg / Kg, Wayasel Hamlet (Station II) 113,552.99 µg / Kg, and Kayeli Village (Station III) 2,138 µg / Kg. The results of the mercury content in the soil in Anahoni, Wayasel and Kayeli Villages can be seen in Figure 1.2 below.

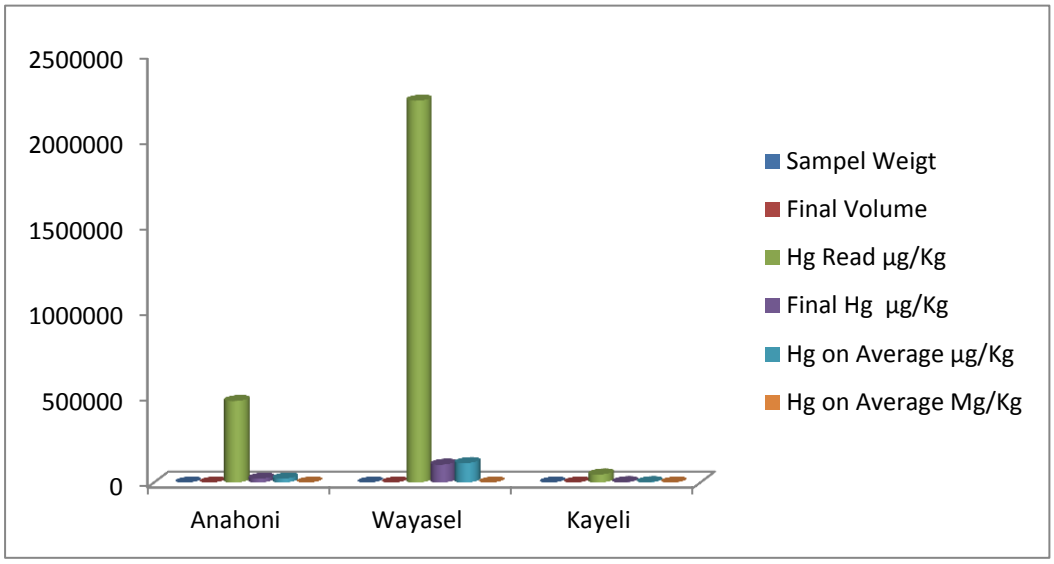


Figure 1. Graphic Mercury content in the soil in Anahoni, Wayasel and Kayeli Villages, Teluk Kayeli District, Buru Regency.

While the research results of the mercury content in the water in Anahoni Hamlet, Wayasel Hamlet and Kayeli Villages can be seen in Table 3 below:

Table 3. The average mercury content in the water in Anahoni, Wayasel and Kayeli Villages, Teluk Kayeli District, Buru Regency.

No	Code	Final Vol.	Hg Read (µg/Kg)	Final Hg (µg/Kg)	Hg on Average (µg/Kg)
1	Anahoni	50	1.10	1.09	1.29
2	Wayasel	50	1.002	0.992	0.99
3	Kayeli	50	1.2845	1.2745	1.275

Based on table 3. Mercury content in water in Station I (Anahoni Hamlet) 1.29 µg / Kg, Station II (Wayasel Hamlet) 0.99 µg / Kg and Station III (Kayeli Village) 1,275 µg / Kg. This can be explained that in table 3. mercury content in water contained in Anahoni Hamlet (Station I) is 1.29 ugl / kg, Wayasel Hamlet (Station II) is 0.99 ugl / kg, Kayeli Village (station III) is 1,275 ugl / kg. this can be explained that the highest mercury content is found in Anahoni Hamlet (station I), which is 1.29 ugl / kg. The results of the mercury content in water can be seen in Figure 2. below.

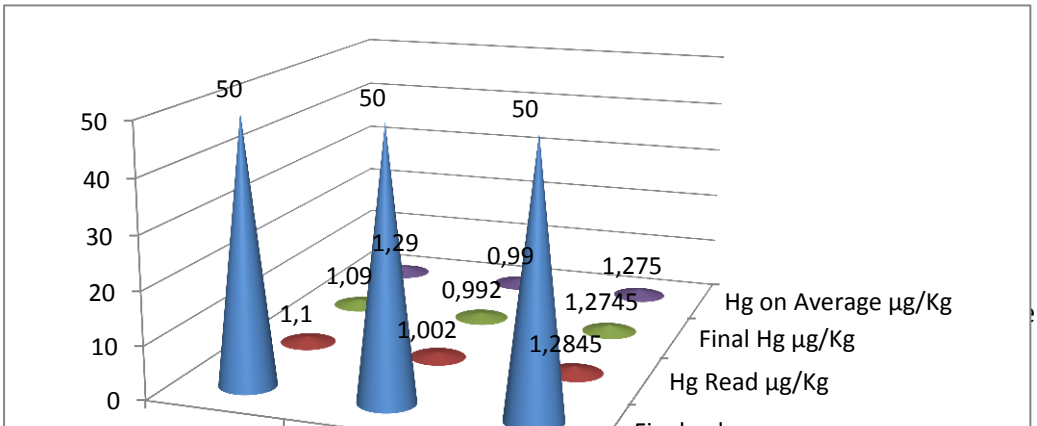


Figure 2. The average content of mercury in water in Amahoni, Wayasel and Kayeli Villages, Kayeli District, Buru Regency.

DISCUSSION

Based on the results of research conducted at 3 locations namely Anahoni Hamlet (station I), Wayasel Hamlet (Station Ii) and Kayeli Village Station III) can be explained that the highest mercury content (Hg) in the soil is found in Wayasel Hamlet (station II), which is 104.24 ugl / Kg, this is due to the large number of gold mining sites using mercury directly, all of which are located near residential areas in the village, besides the use of mercury is done openly without using safety equipment such as masks, gloves, gloves, boots , safety clothing, and other security equipment. The use of mercury can be seen in Figure 3. below.

A B

Figure 3. a. the use of mercury directly in people's homes. b. location of plantations and animal husbandry

Whereas the highest mercury content in water is found in Anahoni Hamlet (Station I), which is 23 ugl / kg, this is due to the direct gold mining process, the waste is channeled into the river, besides that the factory and the refining site are all located near the river. This appears in the picture below.

a **b**

Figure 4. a. Mercury waste is channeled directly into the river. B. The mining process is all located near the river.

Mercury (Hg) is a type of metal that is found in nature and is spread in rocks, ore, soil, water and air as organic and inorganic compounds. Various types of human activities that can increase mercury levels

become high, for example mining activities that can produce as much as 10,000 tons of mercury per year.

Naturally, mercury contamination (Hg) is derived from groundwater seepage from Hg deposits, when entering mercury waters it is easy to bind with chlorine in seawater and form HgCl (organic mercury) bonds. Organic mercury (HgCl) will form HgCl in the form of ions, Hg easily enters plankton and can move to other marine biota.

This HgCl will be turned into organic mercury (Methyl Mercury) by the role of macroorganisms that occur in the bottom waters of sediments. Mercury can also be combined with carbon to form organic compounds, the most common of which is methyl mercury produced by microorganisms in water and soil.

High exposure to mercury can cause damage to the digestive tract, nervous system and kidneys, besides, mercury is also at risk of disrupting various organs of the body, such as the brain, heart, kidneys, lungs to the immune system.

Sometimes Hg with the first symptoms is paresthesia, atexia, deafness and ultimately death, pregnant women who are exposed to mercury can cause damage to the fetal brain, resulting in defects in newly born babies. The results showed that the fetal brain is susceptible to methyl mercury compared to the adult brain. Concentrations of 20 mg HgCl in the blood of pregnant women can already damage the fetal brain.

Mercury has a high affinity for phosphate, cystine, and histiin which are side chains of protein purines, pyrimidines, pteridines, perifines. In low concentrations Hg + ions can inhibit the work of 50 enzymes that cause the body's metabolism is disrupted.

Inorganic mercury salts can cause protein precipitation, damage the digestive tract mucosa, macroorganisms later by fish so that the mercury concentration in fish increases. Methyl Hg has high solubility in the body of aquatic animals so that Hg accumulates through the process of bioaccumulation and biomagnification in animal body tissues. Water, due to the use of Hg by aquatic organisms, is faster than the excretion process.

Chronic damage by mercury can occur due to skin contact, food, drink, and breathing, chronic toxicity in the form of disorders of the digestive system and nervous system or gingivitis. Hg accumulation in the body can cause tremors, Parkinson's, gray eye lens disorders, and anemia, followed by nervous system disorders that damage the kidneys and glomerular membrane filters. This mercury toxicity can also cause exeterma in the form of trauma, bitter taste in the mouth, weak teeth and loss, albuminuria on the skin, erythrocyte decomposition. And reduce blood pressure. Methyl mercury poisoning happened in Japan which caused 110 people to die.

CONCLUSION

1. The highest mercury content (Hg) is found in soil, namely in Wayasel Hamlet (station II) which is 104.24 ugl / kg while the highest mercury in water is in Anahoni Dsun (station I) which is 23 ugl / kg
2. From the results of this study it can be concluded that the mercury (Hg) content found in soil and water, both in Anahoni, Wayasel and Kayeli Villages, Teluk Kayeli District has exceeded the threshold or has been polluted.

Suggestion

1. There needs to be serious attention from the government, both the central government and regional government regarding the existence of gold mining on Mount Botak, Buru Island, because it has a broad negative impact on the lives of people on the island of Buru and the people of Maluku in general.
2. There needs to be a preventive effort in the form of socialization about the dangers of mercury for humans as well as overcoming for hamlets and villages as well as all gold mining areas that have been polluted.

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