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THE IMPACT OF MERCURY (Hg) AND CYANIDE RESIDUES ON MACROZOOBENTOS DIVERSITY IN THE TRANSMIGRATION AREA OF BURU ISLAND RICE PLANTATION

Ali Awan [1]

[1] *Biology Education Study Program FKIP-Unpatti, Indonesia.*

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Correspondence to Author:
Ali Awan
Biology Education Study Program FKIP-Unpatti, Indonesia.

E-mail:
aliawanprof@unsrat.ac.id

ABSTRACT

Heavy metals such as mercury (Hg) and cyanide is extremely harmful to living things, especially humans as well as the influence on the surrounding environment for it can cause pollution. The use of hazardous materials has been used for a long time, especially in the gold mining area on the bald mountain (Gunung Botak) in Buru Island. The use of these hazardous materials greatly affect the quality of the environment and the surrounding paddy fields, due to residues of these hazardous substances are difficult to decompose in nature and can cause biological magnification (biomagnification), which would be detrimental to humans as the highest consumers. This study was conducted to determine the impact of heavy metal residues of mercury (Hg) and Cyanide to environmental quality in rice cultivation by using macrozoobenthos as bioindicator. The study was conducted in the Buru Island Transmigration rice field. Sampling was done by purposive sampling as much as 7 example. The results showed that in locations 1 to 4 locations (mining area) there is no one macrozoobenthos, both from Family to the species. As for the station, 5-7 found 15 species of macrozoobenthos of 4 phylum, the phylum Annelida consisting of 2 classes (Oligochaete and Gnathobdellida), phylum Mollusca consisting of one class (Gastropod), arthropod phylum consisting of one class (Insecta) and phylum arachnid. The occurrence of benthic animal species diversity index in the study area, which means that the quality of the marine environment, including the aquatic environment, is heavily polluted. Residue analysis of heavy

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metals mercury (Hg) and cyanide to land and water in the rice fields and areas of the bald mountain (Gunung Botak), showed heavy contamination. This can be proved by dying livestock farmers, contamination of marine life and the death of horticulture crops.

INTRODUCTION

Mercury (Hg) is a heavy metal that is very dangerous. Hg, Pb and Cd are known as the big metal thread, three heavy metals are very dangerous with the highest level of toxicity on human health (Widle & Beneman, 1993).

Rapid human exposure to mercury (Hg) through the process of inhaling mercury vapours directly or through the food chain if consumed, such as fish, marine life and plants that have been contaminated with mercury, there will be health problems. Such as disruption of kidney and liver function, brain damage, congenital disease, DNA damage and lead to death, as happened in the case of Minamata in Japan (Wilham, 1975, Edward, 1976, Boediono, 2003 and Istahoni, 2018).

Cases of poisoning in Minamata (Japan) is not the worst when compared with the case in the gold mining area on the Bald Mountain, Buru. In Minamata, only the sea is polluted then humans as consumers eat fish or molluscs around the waters. However, people in Mount Botak has obviously not been able to eat fish and molluscs, yet there are already organisms that die, both livestock, marine biota and horticulture crops. (Samuel A. Khouw, 2018). The use of mercury (Hg) and cyanide at the location of Bald Mountain, Wamsait Village, Waelata Subdistrict, Buru Regency in Maluku Province, began to cause a direct impact on local residents and communities in Buru Regency in general.

Rice fields are food-producing lands for humans, also a very complex ecosystem. The existence of human activities in the form of direct or indirect use of chemicals is very influential on the environmental quality of rice fields and the surrounding environment. Chemicals allow humans to obtain a larger harvest, but can also cause disruption to the diversity of biota in the rice fields due to the excessive and unwise use of chemicals.

Macrozoobenthos is an animal that can be used as biological indicators to assess the environmental quality of the rice fields because these animals live in the mud or water that is constantly influenced by the state of water quality and quantity.

The purpose of this study is to determine the impact of the use of heavy metal residues of mercury (Hg) and cyanide in the rice field on the abundance and diversity of macrozoobenthos to assess the environmental quality of paddy fields in the Buru Island transmigration area.

METHODS

Figure 1a. Tube Figure

1b. Wok Figure

1c. potash

Figure 1d. Forna (Drum)

Figure 1e. Lighter

1f. Buton Asphalt

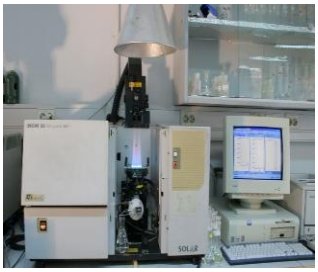


Figure 1g. Spectrophotometry

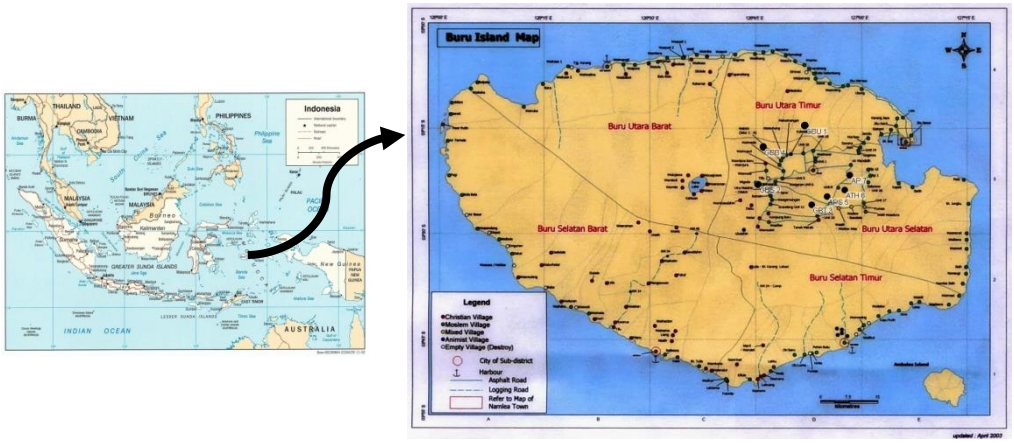
Figure 1h. Scales Figure

1i. Atomic Absorption Frame Square

Figure 1. Tools and Materials Used in Research.

Materials and tools used in this study is a solution of formalin 5%, frame squares, plastic rope, plastic bags, buckets, labels, camera, trays, scales, calculators, AAS (Atomic Absorption Spectrophotometry), tube, forna (Drum), pans, gas/lighters and buton asphalt.

Research sites



Information:

- **Research sites**

GBU 1 : Northern Bald Mountain (Area 1)
GBS 2 : Mount Bald Southern (Area 2)
GBT 3 : Bald Top Mountain East (Area 3)
GBB 4 : Bald Top Mountain West (Area 4)
APS 5 : Paddy Field Area (Area 5)
ATH 6 : Horticultural Crops area (Area 6)
AP 7 : Plantation area (Area 7)

Figure 2. Map Bald Mountain Regions Research in Buru Island.

Macrozoobenthos were collected from seven sampling sites, which is done by purposive sampling using quadratic frame measuring 2m x 2m stretched out perpendicularly to the area of research, namely station 1 to station 4 in the gold mining areas. The mud that was taken was put in a plastic bag, given a 5% formalin solution, labelled, then the sample was sent to the Bogor Soil Laboratory. The same thing is also done when taking water samples. Soil collection was carried out together with macrozoobenthos extraction from several locations, stirred evenly as soil samples. Water and soil samples are put into containers and sent to the Biology laboratory and Bogor Soil laboratory.

To see the relationship between Shannon's diversity and the level of water pollution, Wihlm (1975) criteria is used. The diversity of macrozoobenthos types is calculated using the Shannon Diversity Index formula (Odum, 1971) as follows: $H = -\sum (n1 / N) \log (n1 / N)$.

H Shannon diversity index =
n1 = Number of individuals of a species
N = Number of individuals of all species

RESULTS AND DISCUSSION

The use of mercury (Hg) and cyanide at the location of Bald Mountain, Wamsait Village, Waelata Subdistrict, Buru Regency in Maluku Province, began to cause a direct impact on local residents and communities in Buru Regency in general.

Figure 3a. Sewer Waste

Figure 3b. Immersion area of mercury

Figure 3c. areal Pollution

In addition to permanently damaging the environment, the content of harmful substances in mercury (Hg) and cyanide, has also killed a number of livestock belonging to residents and does not rule out the possibility of residents in Buru Regency being exposed to the effects of these harmful substances. If the circulation of mercury and cyanide remains in the Bald Mountain, then it is certain that the tragedy of mercury chemical contamination (Hg) which occurred in Minamata, Kumamoto Prefecture, Japan in 1958 will occur on Buru Island.

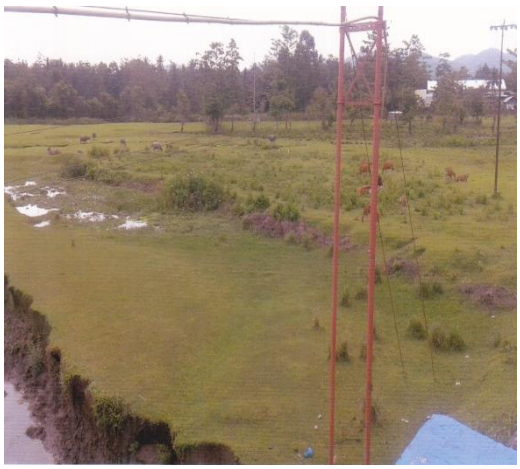


Figure 4a. Not Polluted river

Figure 4b. Polluted river

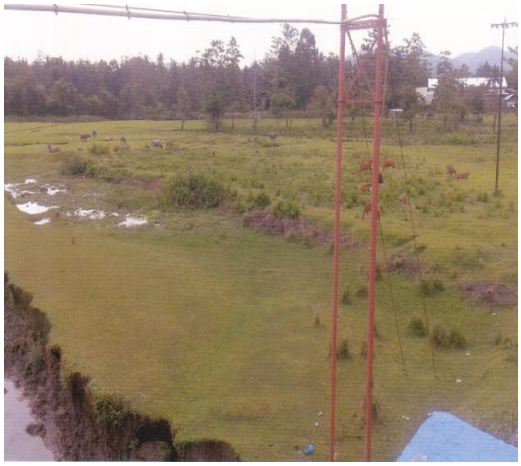


Figure 4c. Dead animals exposed to Mercury (Hg)

Rice fields are food-producing lands for humans, also a very complex ecosystem. The existence of human activities in the form of direct or indirect use of chemicals is very influential on the environmental quality of rice fields and the surrounding environment. Chemicals allow humans to obtain a larger harvest, but can also cause disruption to the diversity of biota in the rice fields due to the excessive and unwise use of chemicals, that clearly can be seen from Bald Mountain.

a. Species Diversity and Abundance macrozoobenthos

All 7 samples taken from the study site in the rice field Transmigration Buru and gold mining sites have been found 18 species of macrozoobenthos that were grouped into 4 phyla, namely Annelida (22.06%), molluscs (20.11%) arthropod (10, 77%) and Arachnida 1%. Annelid phylum includes 2 class (Oligochaete and Gnathobdellida); phylum Mollusca 2 class (gastropods and Lamellibranchiate), phylum Arthropods 1 class (Insecta) and Phylum Arachnida. Type composition and mean abundance (individual / m2) of macrozoobenthos in 7 sampling locations are presented in Table 1.

Table 1. Species Diversity and Abundance macrozoobenthos.

No.	Phylum name	Grade (%)	Percent
1.	annelid	Oligochaete and Gnathobdellida.	22.06%
2.	Mollusks	Gastropods and Lamellibranchiate.	20.18%
3.	Arthropod	Insecta	10.77%
4.	Arachnida	-	1%

The type most commonly found in annelid phylum, the other type is of the type pristine filum osborni annelids, Ophistocysta flagellum, Amphichaeta sp., And Hirudinae sp. The dominant species at the location where the sample came from the phylum Mollusca, namely Bellamyâ javaica, and Melanoides tuberculata. Other dominant species is Lymnea sp., Melanoides sp. and Pita scutata. Of the phylum, Arthropods found two species, namely Allaudomys sp.and Pentaneura sp. Also found Phylum types of arachnids.

Benthic organisms in water are easily affected by the presence of contaminants, especially chemicals. That is due benthos cannot move quickly, and their habitats at the bottom of the waters are where the accumulation of pollutant. Some waters have not damaged by pollution generally characterized by the presence of a community of organisms that have few types but with large populations. At each sampling location, only 3-4 species found only on the rice fields and horticultural crops, while at the site of gold mining macrozoobenthos could not be found (station 1-4). Species found at the site was almost impossible, given the intensive use of materials contaminated with heavy metals such as mercury and cyanide. The toxicity of mercury (Hg) and cyanide greatly affect the abundance and diversity of benthic organisms. Melanoides tuberculata species are found to dominate the location where sampling was conducted. This type has very broad dissemination and has a great tolerance for contamination. On the other hand, water species Tubifex sp. which is also found in the study site is a benthic organism that can be used as indicators of low water quality. Some type of snails also is found in the soil in the rice fields.

Benthic animal species diversity index in the rice fields ranged from 0.872 to 2.921. Relations with the water quality index value is reviewed based on Wilhm (1975) criteria, which have good water quality index of species diversity if it is greater than 3, lightly polluted water quality has an index of 1-3, and heavily

polluted water quality has a small index of 1. Based on the criteria of water quality in the study area, the results were arranged in polluted waters from mild to severe.

Table 2. The Composition Of The Type And Abundance Average (Individuals / M2) In 7Lokasi Macrozoobenthos Sampling.

Species Name	Locations						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Gyroulus convexiuculus	-	-	-	-	10	15	13
Melanoides tuberculata	-	-	-	-	25	5	7
Bellamyâ javanica	-	-	-	-	10	35	25
Lymnae sp.	-	-	-	-	7	15	12
Branchaeta sowerbyi	-	-	-	-	11	45	34
Tubifex sp	-	-	-	-	21	11	11
Hirudinea sp	-	-	-	-	6	5	6
BiliertArachnida	-	-	-	-	4	1	1

In addition around gold mining areas in the bald mountain, miners use the contaminated material, not only just on mercury and cyanide but often use the other contaminated materials, such as described below (Table 3).

Table 3. Type of Contaminated Materials Used By Gold Miners.

No.	Research sites	Contaminated Ingredients Used							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Bald Mountain northern part (GBU) 1	√	√	√	√	√	√	√	√
2	- Bald Mountain southern part (GBS) 2	√	√	√	√	√	√	√	√
3	- Bald Mountain East Section (GBT) 3	√	√	√	√	√	√	√	√
4	- Bald Mountain West Section (GBB) 4	√	√	√	√	√	√	√	√
5	-Areal Rice fields (APS) 5	√	√	√	√	-	-	-	-
6	Holticultural Area (ATH) 6	√	√	√	√	-	-	-	-
7	-Plantation Area (AP) 7	√	√	√	√	-	-	-	-

Information :

No.	Contaminated material
1	Mercury (Hg)
2	Cyanide
3	Castik
4	fluid Ho2
5	diesel fuel
6	Fuel
7	Gas
8	Botas

CONCLUSION

1. The area of horticulture crops in the research area station 1 and station 7 at the sub-district village Waelata Dafa Buru district has been polluted due to excessive use of chemicals.
2. The use of chemicals (mercury) in excess resulting in environmental degradation, especially in rice field ecosystem.
3. Environment quality of horticultural crops in the ecosystem fall into the category of lightly polluted to heavily polluted.

Suggestion

1. The government is expected to restrict or shut down illegal gold mining in the mountain bald for causing pollution and the quality of the environmental ecosystem.
2. Socialization of Government Regulation No. 2 of 1991 on the use of toxic chemicals and insecticides.

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