Section A-Research paper

ANALYSIS OF MERCURY AND CYANIDE LEVELS IN THE ANAHONI RIVER WATERS

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Received:
Received in revised:
accepted:
Available online:

Abstract

Illegal gold mining activities still occur frequently in Buru Regency, which is one of the rivers in Buru Regency, Maluku. This activity causes environmental pollution in the form of mercury (Hg) and cyanide (CN). The purpose of this study was to determine Hg and CN pollution in the Anahoni River, Buru Regency. The results showed that Hg metal was detected in water with concentrations between 0.0003-0.0069 mg/L and sediment concentrations between 0.055-0.209 mg/kg. Meanwhile, CN metal was detected in water other than stations 9 and 10 of 0.002 mg/L and sediment detected at all stations ranged from 0.012-0.326 mg/kg. Statistical analysis shows that the concentration of Hg in river water at stations 3 and 4 has passed the quality standard and the sediment is not above the quality standard,

Keywords: Gold Mining, River Water, Mercury, Cyanide

INTRODUCTION

Buru Regency is dominated by mountainous areas, with the spread of slopes in the northern part of the average steep slope in metamorphic rock formations, while karstic features above sedimentary rock formations (marl and limestone) are more dominant in the south with less steep topography. Buru Regency has the potential for mining materials which is quite large but has not been managed properly. Traditional gold mining in Buru Regency started in 2011, which initially started at the location of Mount BotakWamsait hamletDave VillageWaelata District, and then carried out in four other locations, namely in the areas of Lea Bumi, Gogorea, Derlale/Metar and Waepotih/Waedanga (Irsan et al, 2020).

The gold mining system that is carried out in the Buru Regency area is the same as in other regions in Indonesia. Gold mining is an underground mining system by making tunnels (adit) and wells (vertical shafts). The mining technique is carried out without proper planning and by digging in the direction of the quartz vein which is estimated to have a fairly high gold content. Apart from that, there is also a simple panning system using a wok and a system of spraying soil material using water or known by the miners as dompeng. Currently there is also a sewage treatment system or what is more popularly known as soaking, in which this method uses a variety of hazardous chemicals, especially from the cyanide (CN) group. All of these treatment systems have a negative impact on the environment,(Male et al., 2013).

In general, the gold found in the PETI area in Buru Regency is still fused with the carrier material. In order to get pure gold, miners use a simple panning method, but this method is considered inefficient because it produces relatively small amounts of pure gold, so miners change the panning extraction method to using the amalgamation method using a trommel, which has been used since the end of 2011 with the number of several thousand drummel. Amalgamation technique is a gold processing technique by mixing rocks/materials containing gold metal and mercury using a trommel (steel mill crusher). In this activity a stream of water is needed to separate the fine rock and amalgam (a mixture of mercury and gold),(Male et al., 2013).

According to Lihawa and Mahmud (2012) One of the negative impacts caused by PETI is mercury pollution from the amalgamation process waste, in this process mercury can be released into the environment at the washing and salting stages. In the washing process, waste which generally still contains high concentrations of mercury is discharged directly into water bodies. According to Agustina (2010), certain metals are in concentrationhigh levels will be very dangerous if found in the environment of water, soil and air this will affect health, both in nervous disorders, poisoning, brain damage, defects in babies and miscarriages.

From the description above, this research is important to do, because PETI activities have the potential to contaminate heavy metals Hg and CN to environmental bodies and living things. Objective This research is to determine the content of mercury (Hg) and cyanide (CN) in river water.

METHOD

Location and Time of Research

This research was conducted for three months (90 days), starting from date15 August to 15 November 2022.This research was also conducted at several points on the Anahoni River, namely in the upstream, middle and estuary areas. Besides that, sampling was also carried out on the Waelata River. There are 10 sampling stations in this study.

Data analysis method

River water sampling is composited to make it more representative.All samples tested/analyzed in the laboratorytesting was carried out at the Proling Laboratory of the Bogor Agricultural Institute (IPB).

To see the quality of the waters of the Anahoni River, the results of laboratory analysis on samples and the results of in situ measurements were compared withRepublic of Indonesia Government Regulation No. 101 of 2014 concerning Hazardous and Toxic Waste Management, Decree of the Minister of State for the Environment No. 202 Yr. 2004 concerning Wastewater Quality Standards for Gold/Copper Ore Mining Activities and Government Regulation Number 22 of 2021 concerning Implementation of Environmental Protection and Management.

To determine the sediment status of the Anahoni River in several heavy metal samples, laboratory test results will be compared with several sediment quality standards, namely: Hg (ANZECC/AMRCANZ, 2000) and CN concentrations in sediments will not be compared with quality standards, considering the quality standard sediment for CN has not been determined.

RESULTS AND DISCUSSION

Mercury (Hg)

Mercury or mercury symbolized by Hg is a heavy metal which is classified as the most dangerous pollutant (Gochfeld, 2003). Mercury that enters the aquatic environment will be chokedThe concentration of one of them is in water, although most of it will settle in sediment (Hutagalung, 1991).The results of Hg measurements in water and sediment are shown in Table 1.

Table 1. Measurement Results of Heavy Metal Hg (Mercury) in Water and Sediment

Location Sampling	Station Observation	Sample Code	Hg concentration	
			Water (mg/L)	Sediment (mg/kg)
Upper Anahoni River (mining site)	St. 1	AIAL	0.0018	0.060
	St. 2	AIIBL	0.0007	0.064
Middle of the Anahoni River (mining site)	St. 3	AIIICL	0.0023	0.058
	St. 4	AIVDL	0.0069	0.209
The mouth of the Anahoni River	St. 5	AVEL	0.0008	0.091
	St. 6	AVIFL	0.0005	0.055
	St. 7	AVIIGL	0.0003	0.058
	St. 8	AVIIIHL	0.0003	0.053
Waelata River estuary	St. 9	WIAL	0.0005	0.055
	St. 10	WIIBL	0.0008	0.076
Quality standards			0.002*	1.0*

The results of Hg heavy metal analysis showed that Hg metal was detected in water and sediments at all research stations. In water, Hg has a concentration between 0.0003 - 0.0069 mg/L. This concentration when compared with quality standards based on Class III water based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management, where the maximum limit of Hg in water is 0.002 mg/L, there are several research stations that have passed the quality standard, namely station 3 (0.0023 mg/L) and station 4 (0 .0069 mg/L). The results of this study are in line with the results of research conducted in collaboration with the Buru district government and Iqra Buru University in 2021, where the concentration of Hg in water in the Anahoni and Waelata rivers is 0.0009 - 0.0017 mg/L.

In sediments, Hg has a concentration between 0.055 - 0.209 mg/kg. This concentration when compared with quality standards based onANZECC/AMRCANZ (2000), where the maximum limit of Hg in sediments is 1.0 mg/kg, then the concentration of Hg in sediments at all research stations has not passed the quality standard. In addition, when compared to the concentration of Hg in water and sediment, it can be seen that sediment has a higher concentration of Hg than water at all research stations. The low concentration of Hg in water is due to the fact that Hg in waters precipitates in sediments.

Mercury contamination in sediments occurs due to natural processes (weathering of mineralized rocks), traditional gold processing (amalgamation), and industrial processes that use mercury-containing raw materials. The anomalous value of Hg in sediments must be carefully evaluated considering the high probability of contamination due to the use of mercury by illegal gold mining (PETI). Rocky bottom contours are usually unmineralized. Mercury concentration is closely related to the use of mercury in the amalgamation process (Widhiyatna et al., 2005).

Cyanide (CN)

The results of cyanide measurements in water and sediment are shown in Table 2.

Table 2. Results of Cynide (CN) Measurements in Water and Sediments

Location Sampling	Station Observation	Sample Code	Cyanide Concentration	
			Water (mg/L)	Sediment (mg/kg)
Upper Anahoni River (mining site)	St. 1	AIAL	0.18	0.081
	St. 2	AIIBL	0.032	0.126
Middle of the Anahoni River (mining site)	St. 3	AIIICL	0.092	0.326
	St. 4	AIVDL	0.024	0.099
The mouth of the Anahoni River	St. 5	AVEL	0.056	0.206
	St. 6	AVIFL	0.081	0.287
	St. 7	AVIIGL	0.092	0.322
	St. 8	AVIIIHL	0.051	0.188
Waelata River estuary	St. 9	WIAL	<0.001	0.009
	St. 10	WIIBL	<0.001	0.012
Quality standards			0.002*	-

The results of Cyanide (CN) analysis at each research station are shown in Table 2. It shows that cyanide was not detected only at station 9 and station 10 (<0.001 mg/L), while at other stations cyanide was detected in water and its concentration was above the quality standard. cyanide in Class III water based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management, namely 0.002 mg/L. The highest concentration of cyanide is found at station 1 which is the closest station to the gold mine in the Anahoni area. In this area, cyanide is also detected with high concentration. Meanwhile, stations 9 and 10, which were not detected by cyandia, were not centers for smallholder gold mining in the Anahoni area.

In sediments, cyanide was detected at all research stations with values ranging from 0.012 - 0.326 mg/kg. The concentration of cyanide in sediments is also higher than its concentration in water. This value differs from water, in which there are stations where cyanide is not detected. No cyanide was detected in the water, but it was detected in the sediment indicating that a lot of cyanide had accumulated in the sediment at the station.

Based on Table 2 it can also be seen that CN concentrations were spread over all research stations with high concentrations (except station 9 and station 10) and reached dangerous levels in the waters. This shows that it is not only the rivers in the Anahoni mining area that have been polluted with CN, but the nearby river (Waelata River) also receives the CN pollution load. CN contamination in these two river locations indicates that processing of gold material does not only occur at the mining location directly, but processing using CN can occur in various areas, especially in areas close to mining areas.

CONCLUSION

Based on the results of the analysis, it was found that the mercury content in river water was above the quality standard at station 3 (0.0023 mg/L) and station 4 (0.0069 mg/L), while the concentration of mercury in sediments had not passed the quality standard. The cyanide content in river water is above the quality standard at stations 1 – 9 and the cyanide concentration in the sediment has exceeded the quality limit.

ACKNOWLEDGEMENT

The author thanks Upper Buru District Government support in this research activity, and to laboratory staffProling Bogor Agricultural Institute (IPB)for his assistance in the analysis of river water samples. The author also expresses his gratitude to the reviewers who have provided input for improvements, so that they can add weight to this paper in a better direction

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