Determination Of Mercury (Hg) On Water Sample In Batang Kuantan River

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Abstract:

Batang Kuantan River is a river that still has a wild gold mine along the flow. Problems arising from the gold mine is the content of the metal it produces, one of which is mercury. Mercury is used in gold mining This research was conducted to see the mercury contained in the water in the flow of Batang Kuantan river. Geochemical studies have been performed by determining the pH and concentration of metal mercury (Hg) determination in water samples using Atomic Absorption Spectrophotometer (AAS). The results showed that The concentration of Hg on samples A1 and A3 is 0.009 mg / L and 0.0078 mg / L. The A2 and A3 samples found a low reading of the limit of detection. The concentration values of Hg samples A1 and A4 are above the standards specified by PP No.82 tahun 2001 i.e 0.002 mg/L.

Keywords: Mercury, River Water , Gold Mine

I. INTRODUCTION

Batang Kuantan River located in Sijunjung Regency is believed to have a wild gold mine which is located around the waters of the river [1]. This gold mining activity is believed to cause significant environmental damage. One of the most troubling problems for people around the location of Unlicensed Gold Mining (PETI) is heavy metals resulting from gold mining activities such as Cd metal derived from natural metal dissolution due to soil excavation and rock destruction. Accumulation of heavy metal Cd beyond the allowable limit may cause impaired renal function and cause injury to the nasal passages and skin [2]. In addition to the heavy metals produced by such PETI activities, anions such as nitrate will also harm human health [3].

One form of damage caused by gold mining by the people is mercury contamination of amalgamation process of gold processing. In the traditional gold amalgamation process by the people, mercury can be released into the environment at the stage of washing and roasting. In the washing process, waste that is generally still contain mercury is discharged directly into the body of water. This is due to the mercury is mixed / split into fine grains that are difficult to separate in the process of grinding is done

simultaneously with the amalgamation process, so that in the process of washing mercury in the waste carried into the river [4].

Mercury is found naturally in small quantities throughout the environment. It is released by the breakdown of minerals in rocks and soil and as a byproduct of fossil fuel combustion and waste incineration. It is inhaled with the air that we breathe, absorbed through the skin, and ingested with food. The tiny amounts to which the vast majority of people are exposed do not generally cause health concerns, but exposure to excessive amounts of mercury can be toxic. The amount of mercury absorbed by an individual and its effects on his or her health depend on the type of mercury whether elemental, inorganic or organic metallic, its concentration, and the exposure time. According to the Agency for Toxic Substances and Disease Registry (ATSDR), very little metallic mercury (less than 0.01%) is absorbed by the body, even if it is swallowed. However, if the same mercury is inhaled as a vapor, about 80% is absorbed into the bloodstream [5].

The spread of Hg in soil, water, or air through various channels such as solid or liquid waste disposal discharged into soil, air, and water. Surface water pollution and surface water by mercury has reached 25 percent of 2,783 samples tested by U.S. Environmental Protection Agency (EPA). Groundwater surveys have also detected mercury concentrations in some supplies of drinking water [6].

The use of mercury (Hg) especially gold mining to separate gold from sand grains through the amalgamation process and the combustion process (alloy). Hg-containing tailings are discharged around the settlement making it potentially contaminating soil and groundwater.

Elements of mercury or mercury are chemicals used in the processing of gold. The absorption of mercury oxide (HgO) is mostly through the respiratory system and the amount entering the body is as great as that between the nasal or mouth sucking (about 80%) [7:8]. Once released into the environment mercury is never broken down to a harmless form and exists in the atmosphere, soil and aquatic phase. It transform into very stable organic compounds such as methyl mercury which has a strong bioaccumulation and can be finally taken by humans [9].

Research on the mercury content produced by wild gold mining previously been implemented by Reference 10, where mercury levels in the source of clean water and drinking water, especially river water used as a source of drinking water by people around PETI Kecamatan Kurun Gunung Mas District exceeds the limit which established Permenkes 1990 and 2002 with an average mercury level of 0.003 mg / L.

Badan Lingkungan Hidup Kota Palu (2011), has also conducted a study related to mercury content in ground water, river water and seawater in the city of Palu at some point in 2010 recorded 0.0036 ppm far above the threshold of 0.0005 ppm.

Therefore, the research of Determination of mercury (Hg) on water sample in Batang Kuantan River was conducted to find out mercury concentration in the river water sample of Kuantan river.

II. THE MATERIAL AND METHOD

This research was conducted on the area around the river flow of batang kuantang in West Sumatra. Where it is believed that at this location is often done illegal gold mining activities that allow the presence of mercury (Hg) in samples taken in the area. There are 4 specified sample locations using Global Positioning System (GPS) tool aid. The four sample sites are within a radius of 5-10 m from gold mining. Water samples was collected in 4 different sample location along the river and collected randomly in a 1000 ml plastic container and preserved with concentrated nitric acid.

Geochemical studies have been performed by determining the pH and concentration of metal mercury (Hg) determination in water samples using Atomic Absorption Spectrophotometer (AAS). In determining the pH of the water sample used SNI 06-6989.11.2004 test method while in determining the mercury concentration used test method of SNI 6989.78: 2011.

III. RESULT AND DISCUSSION

pH Level

Research on pH levels in water samples in all four locations around the quantan river rivers found varying pH levels. The pH levels for the water samples are shown in Table 1.

Table 1. pH Level on Sample

No	Sample Code	pH
1.	A1	6.01
2.	A2	6.05
3.	A3	6.09
4.	A4	5.91
Mean		6.02

The results of pH measurements on water samples in quantan rod rivers at the four sample sites found that at the A1-A3 sample sites are still within the standard set by Ref [11] i.e 6-9. While the A4 sample location is below the standard set by PP No. 82 tahun 2001 i.e 6-9. On average, the overall pH level in batang kuantan river is still within the established standard set by Ref [11] i.e 6-9. The pH value of water sample on Batang Kuantang river on average 6.02.

The pH value is influenced by several parameters, including biological activity, temperature, oxygen content and ions. From the biological activity produced CO₂ gas which is the result of respiration. This gas will form buffer ions or buffers to keep the pH range in the waters stable [12]. The lower the pH value, the higher soil acidity.

The results of this study found that all water samples collected were slightly acidic. Reference [13] states that the more acidic the pH of a sample is then enhance the mobility of mercury in the environment likewise its adsorption to clay and mineral oxides of iron, aluminum and silicon.

Mercury (Hg)

Testing of mercury (Hg) concentration has been performed using Atomic Absorption Spectrophotometer (AAS). The Hg concentration in the water samples in the four sample locations is shown in Table 2.

Table 2. Concentration of Hg on Water Sampel

No	Sample Code	Hg (mg/L)
1.	A1	0.009
2.	A2	<0.0003*
3.	A3	<0.0003*
4.	A4	0.0078

* *LoD= Limit of Detection*

On Sample location A1 found that the concentration Hg value is 0.009 mg/L. This value is above the standard set by PP No.82 tahun 2001 i.e 0.002 mg/L. On Sample location A2 and A3 found that the concentration Hg value is <0.0003 mg/L. This value is below the standards set by PP No.82 tahun 2001 i.e 0.002 mg/L. On Sample location A4 found that the concentration Hg value is 0.0078 mg/L. This value is above the standard set by PP No.82 tahun 2001 i.e 0.002 mg/L. Location A1 and A4 is the closest location to the gold mine in the Batang Kuantan river, allowing it to have a higher Hg concentration in comparison with the more remote A2 and A3 locations. The gold mining around the Batang Kuantan river uses amalgamation processing.

In the traditional gold amalgamation process by the people, mercury can be released into the environment at the stage of washing and roosting. In the washing process, waste that is generally still contain mercury is discharged directly into the body of water. This is due to the mercury is mixed / split into fine grains that are difficult to separate in the process of grinding is done simultaneously with the amalgamation process, so that in the process of washing mercury in the waste carried into the river [4].

Comparism of Mercury (Hg) Concentration with WHO limit

The concentration of mercury (Hg) in the whole sample of batang kuantan river can then be compared with WHO limit as it is shown in Figure 1 below. The concentration of mercury in water sampel A1 and A4 was high compared to 0.001mg/L limit recommended by WHO. This could be detrimental to the communities around the river who depend solely on the water from the river for their livelihood like for drinking, washing, bathing etc. EPA report has revealed that elevated mercury levels has been linked to learning disabilities and developmental delays in children and to heart nervous system and kidney damage in adults.

Other than that the pH in the water samples in A1 and A4 is the most acidic compared to the water samples in A2 and A3 so as to support that the A1 and A4 samples are of higher Hg concentration. Reference [13] suggest that the more acidic the pH of a sample is then enhance the mobility of mercury in the environment likewise its adsorption to clay and mineral oxides of iron, aluminum and silicon.

Fig. 1. Comparism of Mercury (Hg) Concentration with WHO limit

The presence of Hg in the river may occur due to gold / mining processing activities ie amalgamation and bleaching process, where Hg can enter the ground water / surface water through seepage and rain water that drops along with Hg in amosfir [14].

IV. CONCLUSIONS

The concentration of Hg on samples A1 and A4 is 0.009 mg / L and 0.0078 mg / L. The A2 and A3 samples found a low reading of the limit of detection. The concentration values of Hg samples A1 and A4 are above the standards specified by PP No.82 tahun 2001 i.e 0.002 mg/L.

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