IDENTIFICATION OF COMMUNITY DISEASE SYMPTOMS AROUND COMMUNITY GOLD MINES IN TERMS OF LENGTH OF STAY (>5 YEARS) IN THE WORKING AREA OF THE UPTD PUSKESMAS UJUNG PADANG RASIAN, SOUTH ACEH DISTRICT

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Abstract

Mercury (Hg) is a toxic material widely used in gold mining to refine the metal. The amalgamation process in gold processing has been shown to damage the environment and human health. Natural sources of mercury include volcanic gas and seawater evaporation. Mercury can enter the human body through skin contact, vapor inhalation, and consumption of contaminated fish. The study was conducted in June 2023 on 47 residents around gold mines in the Working Area of the UPTD Puskesmas Ujung Padang Rasian, South Aceh District, Aceh Province. The majority of respondents were male (97.10%) with an age range of 26-35 years (37.10%). The majority had S1 education (45.70%) and lived there for 17-25 years (22.80%). Common acute clinical symptoms included cough, nausea, vomiting, headache, diarrhea and abdominal pain. Chronic symptoms included somatosensory disturbances, headaches, muscle cramps, tremors, erythema and weight loss. The majority of respondents experienced symptoms such as cough (31 respondents), nausea (30 respondents), vomiting (25 respondents), headache (24 respondents), and diarrhea (18 respondents) due to mercury exposure.

Keywords: *Mercury, Community, Gold Mine, Symptoms of Disease, Environment*

1. INTRODUCTION

Mercury (Hg) is a toxic material that can have harmful effects on humans and the environment. It is widely used in the gold mining process which serves to purify precious metals. Gold processing using amalgamation techniques is known to damage the environment and pose a risk to human health (Lensoni et al., 2023). Mercury is also one of the heavy metal pollutants and is a natural element that often pollutes the environment and is highly accumulative toxic. In the environment, this element is bound to other chemical elements that are distributed in corals, soil, air, water and even in living organisms. Mercury is rarely found in its free form.

The distribution of mercury is influenced by complex geological, physical, chemical and biological factors (Polii & Sonya, 2002). Metal mercury (Hg) is a trace element that has liquid properties at room temperature with specific gravity and high electrical conductivity. Because of these properties, mercury is widely used in both industrial and laboratory activities (Prasasti et al., 2006). Sources of mercury pollution fall into two broad categories, namely those of natural origin and those from mining. Naturally, Hg can come from volcanic gas and evaporation from sea water.

The metal foundry industry and all industries that use Hg as a raw or auxiliary material, its waste is a source of Hg pollution. Another activity that is a source of Hg

pollution is the practice of dentists who use amalgam as a tooth filling material. In addition, fossil fuels are also a source of Hg (Putranto, 2011).

Mercury produced by the mining process can be deposited on the surface resulting in the entry of mercury pollution into the soil and into the groundwater environment through cracks carried by rainwater entering the soil. Elemental mercury pollution in the soil occurs due to the weathering process of mineralized rocks or due to thinning in gold processing (Goldman et al., 2001). Mercury is released into the atmosphere in the form of mercury vapor resulting from the amalgam combustion process (Lensoni, Adlim, Kamil, & Karma, 2023). Can be in the atmosphere for long periods of time and can travel considerable distances through the air (Gonzalez-Raymat et al., 2017). For mercury (Hg) exposure, which is through the food route (usually from consumption of contaminated fish where Hg exposure is in the form of Me-Hg), Hg levels in hair are examined, while biomarkers of airborne Hg exposure (exposure to Hg amalgam or inorganic Hg), Hg levels in urine or Hg levels in blood are examined (Zulaika et al., 2011).

Mercury enters the body in several ways, such as through direct skin contact, inhalation of mercury vapor, and eating mercury-contaminated fish (Widowati et al., 2008). Pregnant mothers can transmit organic mercury to the fetus through the placenta, damaging the brain and organs of the fetus and causing retardation and even death. Infants and young children contaminated with mercury may experience learning difficulties or low intelligence levels (Pereira Filho et al., 2004).

Mercury exposure in gold processing occurs during the screening and emission process. In the screening process, Mercury that is still in inorganic form will be absorbed and enter the body through the skin because in the screening process Mercury is mixed, while in the process of spinning, the processor will be exposed to Mercury vapor through inhalation because the gold ore that has been bound with Mercury will be heated at a very high temperature and there will be Mercury (Hg) evaporation into the human body through the respiratory tract usually accumulates in the human body and can cause disease disorders in a person (Bangun, 2015) Inorganic mercury and aryl mercury are distributed in many body tissues, especially in the brain and kidneys.

Mercury is bound to sulfhydryl and can affect a number of cellular enzyme systems. The production of metallothioneins (sulfhydryl-rich low molecular weight proteins) increases after mercury exposure and may affect the protective effect on the kidneys. Alkyl mercury has a strong bond with carbon-mercury and accumulates in the central nervous system. In the bloodstream, the largest absorption of alkyl mercury is found in red blood cells (Berniyanti, 2020).

Long-term exposure to mercury is known to cause health problems, especially in individuals living in mercury-contaminated environments. Mercury poisoning in communities around mining sites is usually chronic. Individuals who live in a mercury-polluted environment are seven times more likely to have mercury levels in their hair higher than the threshold compared to those who only live briefly in the neighborhood. Clinical symptoms of mercury poisoning usually appear within 5-10 years, depending on exposure in the environment. Human exposure to mercury can be determined by measuring mercury levels in body tissues such as hair, blood, urine, nails, and breast milk (Lensoni et al., 2023).

The effects of such exposure can be both acute and chronic poisoning. Acute mercury poisoning is characterized by damage to the digestive tract, cardiovascular disorders, acute renal failure, skin, and shock. Meanwhile, chronic mercury poisoning is characterized by disorders of the digestive system, heart, nervous system such as tremors, impaired eye lenses, and mild anemia (Kristianingsih, 2018). The health effects of mercury are mainly related to the nervous system, which is very sensitive to all forms of mercury. The symptoms felt by the patient are sleep disturbances, mood changes, tingling from the area around the mouth to the fingers and hands, reduced hearing or vision and reduced memory. Damage to the cerebellum, sufferers show clinical symptoms of tremors, impaired coordination, impaired balance, staggering (ataxia) which causes people to be afraid to walk (Widowati et al., 2008).

The writing of this article aims to help identify symptoms of disease in communities living around gold mines. Gold processing activities carried out in South Aceh Regency still use the amalgamation technique, which uses mercury in the processing process. The impact of mercury can cause annual diseases because mercury is toxic so it is not good for health. For this reason, researchers want to see the identification of symptoms of diseases caused by people living around gold mines caused by mercury.

2. RESEARCH METHODS

This study was conducted in June 2023 involving 47 people whose length of stay was more than 5 years. The research site was located in the working area of the UPTD Puskesmas Ujung Padang Rasian, South Aceh Regency, Aceh Province, Indonesia. This location was chosen based on the consideration that gold processing has been running for more than 5 years. This study examined the clinical symptoms experienced by the community due to mercury exposure. Respondents from the selected community are people who live around the gold processing area and are believed to frequently interact with the processing activities. All respondents were observed, interviewed, and vital signs checked. This study focused on identifying the symptoms of acute and chronic toxicity experienced by communities around gold mines. In the study, respondents were given a questionnaire in accordance with WHO guidelines that listed symptoms that commonly occur when exposed to mercury. The protocol in this study has received ethical approval through letter No.076/KEP-UNISM/IX/2023 (dated September 9, 2023) from the Research Ethics Commission of Sari Mulia University Banjarmasin.

3. RESULTS AND DISCUSSION

3.1. Research Result

3.1.1. Respondent Characteristics

The characteristics of respondents to be studied are gender, age, education, and length of stay.

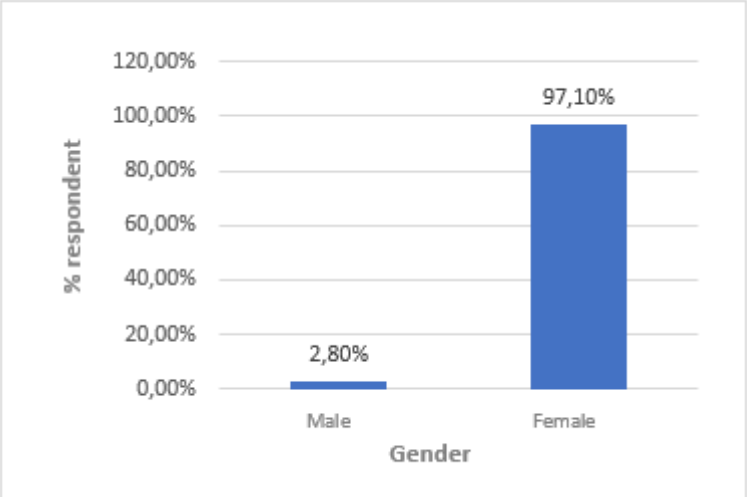

Figure 1. Gender Characteristics of Respondents

Based on Figure 1. shows that the majority of female respondents are (2.80%) and the majority of male respondents are (97.10%). So from that it can be seen that there are more female respondents than male respondents.

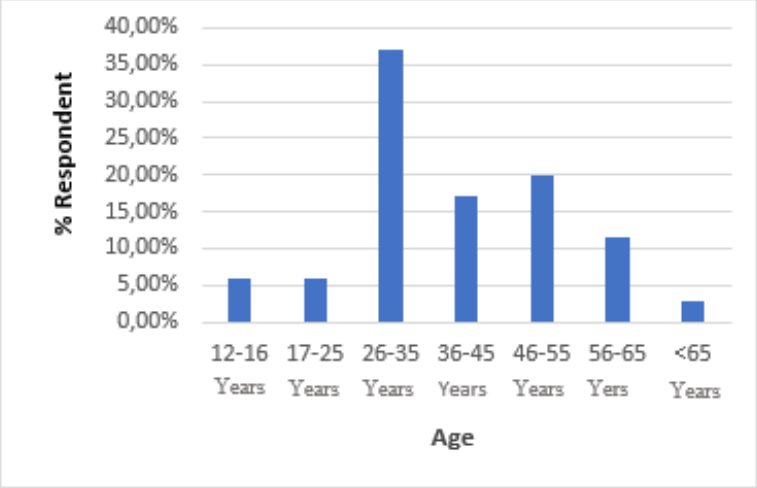

Figure 2. Age characteristics of respondents

Based on Figure 2. It is known that the highest majority of respondents aged 26-35 years are as many as (37.10%) respondents, then at the age of 46-55 years as many as (20%), age 36-45 as many as (17.10%), age 56-65 years as many as (11.40%), at the age of 12-16 years and 17-25 years the respondents were each as many as (5.80%), and the lowest majority of age respondents were seen at the age of >65 years as many as (2.80%).

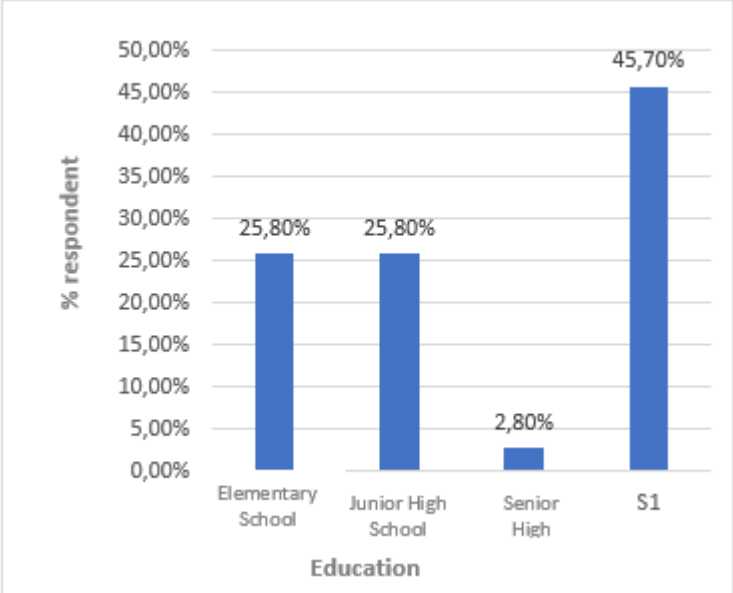

Figure 3. Characteristics of respondents Education

Based on Figure 3. shows that the highest majority of respondents' education is S1 as many as (45.70%) respondents, while respondents who have elementary and junior high school education each have (25.80%) respondents, and the lowest majority of respondents' education is high school as many as (2.80%) respondents.

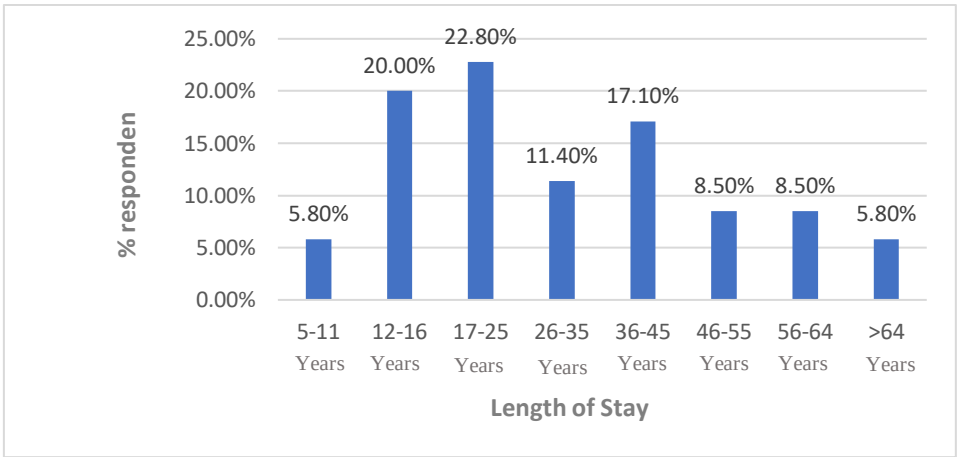

Figure 4: Characteristics of respondents' length of stay

Based on Figure 4. It can be seen that the majority of respondents who stayed the longest were 17-25 years as many as 22.80% of respondents, who stayed 12-16 years as many as (20.00%) respondents, who stayed for 26-35 years as many as (11.40%) respondents, 46-55 years and 56-64 years as many as (8.50%) respondents, and the majority of the length of stay was the lowest 5-11 years and >65 years as many as (5.80%) respondents.

3.1.2. Symptoms of Disease in Gold Processing Workers

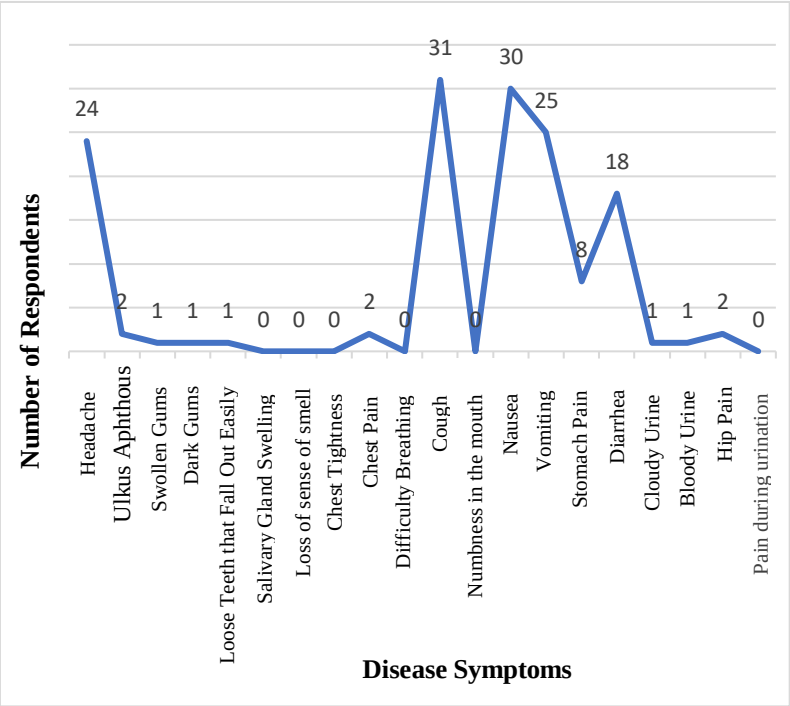

Figure 5. Symptoms of acute illness

Based on Figure 5. The results of the examination of mercury levels in the community around gold miners obtained the results that the acute clinical symptoms of the community were the majority of respondents experiencing symptoms of cough (31 respondents), nausea (30 respondents), vomiting (25 respondents), headache (24 respondents), diarrhea (18 respondents), abdominal pain (8 respondents), symptoms of pelvic pain, chest pain and aphthous ulcers (2 respondents), and symptoms of bloody urine, cloudy urine, loose teeth that fall out easily, dark gums and swollen gums each (1 respondent). While the symptoms of numbness in the mouth, difficulty breathing, chest tightness, loss of sense of smell, and salivary gland swelling were not experienced by any respondent.

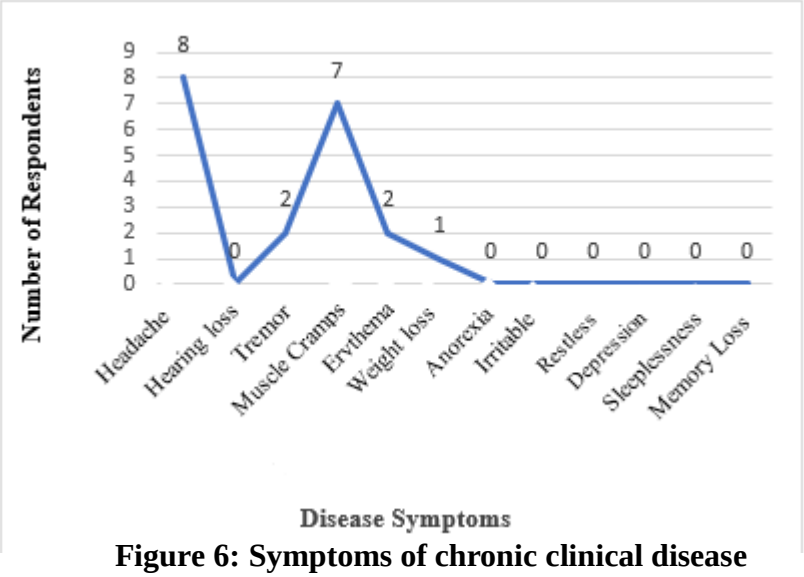

Figure 6: Symptoms of chronic clinical disease

The figure above shows an overview of the analysis results. Symptoms of chronic toxicity recorded include somatosensory disorders in the community around the gold mine. The majority of people experienced headaches (8 respondents), muscle cramps (7 respondents), tremors and erythema (2 respondents), and weight loss (1 respondent).

3.2. Discussion

In the picture, it can be seen that most of the community has been exposed to mercury, the people who live around the gold miners experience symptoms or health problems, this information is an indication that it is appropriate to be aware of and there needs to be a better countermeasure, so that the community is not in a worse condition. The symptoms of illness that arose in the community were symptoms of cough (31 respondents), nausea (30 respondents), vomiting (25 respondents), headache (24 respondents), diarrhea (18 respondents), abdominal pain (8 respondents), symptoms of pelvic pain, chest pain and aphthous ulcers each (2 respondents), symptoms of bloody urine, and cloudy urine (1 respondent). Dark lines of mercuric sulfide can form on loose teeth that fall out easily, dark gums, swollen gums each (1 respondent), no respondent has salivary gland swelling, numbness in the mouth and occasionally can experience respiratory problems such as difficulty breathing, loss of sense of smell and chest tightness. These symptoms can be said to be symptoms of acute illness. Mercury poisoning is a very dangerous poisoning because it can cause central nervous system disorders.

The classic triad of chronic mercury vapor poisoning is the most characterized neurological and psychological symptoms. Early nonspecific symptoms were headache (8 respondents), muscle cramps (7 respondents), erythema (2 respondents), weight loss (1 respondent), followed by the more characteristic disorders of anorexia, insomnia, anxiety, depression and irritability, to which no respondent was exposed. More serious problems such as memory loss and hearing loss were also absent. Mercury tremor is a mixed type (persistent and intentional tremor), first appearing as a subtle tremor of the closed eyelids, lips and tongue and fingers. The tremor is sustained to the arms and finally

the whole body in this symptom the respondents who experienced the disease were (2 respondents).

Passos' 2008 study showed mercury contamination due to gold mining around the Amazon, namely the presence of mercury toxicity in the urine and blood of workers along with signs and symptoms of mercury poisoning, as well as mercury contamination in the environment both in water sources, sediments, and fish in the Amazon consumed by local communities (Baker, 2008). According to (Siringoringo et al., 2022) the impact of mercury on health depends on the amount of mercury exposure, the duration of exposure and the form of exposure itself in acute exposure characterized by fever, fever, shortness of breath, metallic taste, chest pain (pleuritas) and others. Meanwhile, according to Agustina, high levels of mercury can cause ataxia, decreased speech and hearing, tremors, dysarthria. At the acute level, these symptoms usually worsen accompanied by paralysis, insanity, coma, and eventually death, so that if it accumulates into the human body for a long time it will have a very impact and harm humans (Agustsina et al., 2023)

This study is in line with Lensoni's research (2023) which states measuring urinary mercury levels in communities around gold processing sites. The participants were the community around Paya Seumantok Village, Krueng Sabe District, Aceh Jaya Regency (n=91). The study began with explaining the purpose of the study and collecting participants' urine samples. They signed a consent form before participating in the study. Mercury was detected in seventy-five out of ninety-one urine samples. The mean urinary mercury level was 8.392 µg/L (SD: 6.721 µg/L), with minimum and maximum detected mercury levels of 0.19 µg/L. The average level found in this study exceeded the threshold set by Human Biomonitoring (HBM) of 7 µg/L. (Lensoni, Adlim, Kamil, & Karma, 2023)

This study is similar to research by Tugaswati T. (1997) which states that the distance of residence to gold processing sites is one of the factors that can affect mercury poisoning, the closer the distance of residence, the greater the chance of mercury poisoning. According to the results of research conducted by Nita Ratna Junita also stated that there is a statistically significant relationship between house distance and mercury poisoning. The researcher obtained the results for the average mercury level in respondents who lived more than 261 meters was 0.505 ppm, while respondents who lived less than 261 meters was 0.602 ppm. (Junita, 2013).

Hawleys (1981) and Alfred (2022) also conducted research on mercury compounds that are highly toxic and can enter through breathing and skin absorption with a tolerance limit of 0.05 mg/m3 in air. In the presence of oxygen, mercury will be acidified directly into ionic form. Mercury vapor is in the form of a watch which, when absorbed into the body, will go to alveolar (Brodziak-Dopierała & Fischer, 2022).

4. CONCLUSION

From the study, it can be concluded that the majority of respondents who experienced many symptoms of illness due to exposure to mercury were cough symptoms (31 respondents), nausea (30 respondents), vomiting (25 respondents), headache (24 respondents) and diarrhea (18 respondents).

REFERENCES

Agustina, D., Nursa'adah, E., & Ruyani, A. (2023). Morfometrik Ikan Cere (Gambusia affinis) dan Ikan Putian (Rasbora argyrotaeni) yang Terpapar Merkuri di Sungai Tambang Saweak Kabupaten Lebong. *Bioscientist: Jurnal Ilmiah Biologi*, *11*(1), 551–560.

Baker, J. P. (2008). Mercury, vaccines, and autism: one controversy, three histories. *American Journal of Public Health*, *98*(2), 244–253.

Brodziak-Dopierała, B., & Fischer, A. (2022). Analysis of mercury content in various types of tea (Camellia sinensis) and yerba mate (Ilex paraguariensis). *International Journal of Environmental Research and Public Health*, *19*(9), 5491.

Goldman, L. R., Shannon, M. W., & Health, C. on E. (2001). Technical report: mercury in the environment: implications for pediatricians. *Pediatrics*, *108*(1), 197–205.

Gonzalez-Raymat, H., Liu, G., Liriano, C., Li, Y., Yin, Y., Shi, J., Jiang, G., & Cai, Y. (2017). Elemental mercury: Its unique properties affect its behavior and fate in the environment. *Environmental Pollution*, *229*, 69–86.

Junita, N. R. (2013). *Risiko Keracunan Merkuri (Hg) pada Pekerja Penambangan Emas Tanpa Izin (PETI) di Desa Cisarua Kecamatan Nanggung Kabupaten Bogor Tahun 2013*.

Kristianingsih, Y. (2018). Bahaya Merkuri Pada Masyarakat Dipertambangan Emas Skala Kecil (Pesk) Lebaksitu. *Jurnal Ilmiah Kesehatan*, *10*(1), 32–38.

Lensoni, Adlim, Kamil, H., Karma, T., & Suhendrayatna. (2023). Description of Mercury Poison Clinical Symptoms in Workers and Communities Around the Small-Scale Gold Processing Area. *Proceedings of Malikussaleh International Conference on Multidisciplinary Studies (MICoMS)*, *3*, 00034. https://doi.org/10.29103/micoms.v3i.193

Lensoni, Adlim, M., Kamil, H., & Karma, T. (2023). Identification and Correlation Test of Mercury Levels in Community Urine at Traditional Gold Processing Locations. *Journal of Ecological Engineering*, *24*(3), 357–365. https://doi.org/10.12911/22998993/159062

Polii, B. J., & Sonya, D. N. (2002). Pendugaan kandungan merkuri dan sianida di daerah aliran sungai (DAS) Buyat Minahasa. *Ekoton*, *2*(1).

Prasasti, C. I., Mukono, J., & Sudarmaji, S. (2006). Toksikologi logam berat B3 dan dampaknya terhadap kesehatan. *Jurnal Kesehatan Lingkungan Unair*, *2*(2), 3956.

Putranto, T. T. (2011). Pencemaran Logam Berat Merkuri (Hg) pada Airtanah. *Teknik*, *32*(1), 62–71.

Siringoringo, V. T., Pringgenies, D., & Ambariyanto, A. (2022). Kajian Kandungan Logam Berat Merkuri (Hg), Tembaga (Cu), dan Timbal (Pb) pada Perna viridis di Kota Semarang. *Journal of Marine Research*, *11*(3), 539–546.

Widowati, W., Sastiono, A., & Jusuf, R. (2008). Efek toksik logam pencegahan dan penanggulangan pencemaran. *Penerbit Andi. Yogyakarta*, 2–206.

Zulaika, E., Widiyanti, A., & Shovitri, M. (2011). Bakteri resisten merkuri endogenik hilir Kalimas Surabaya. *Seminar Nasional Teori Dan Aplikasi Teknologi Kelautan SENTA*.

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