CHAPTER I

INTRODUCTION

A. Background of the Study Area

Indonesia has a competitive and active domestic market for gold, particularly as many locals see it as a form of savings, rather than investment. With Asia's third largest population (250 million), behind China and India, Indonesia has a vibrant physical gold market with an internationally recognised gold refinery a large gold jewellery sector and wide availability of retail investment gold bar products (Indonesian Gold Market). In 2020, approximately 65.89 thousand metric tons of gold were produced in Indonesia, indicating a decrease from around 108 thousand metric tons in the previous year, Indonesia is one of the world's top ten gold producer (Statista Research Department). Addition to this, the rise in demand and prices of gold in the last two decades triggered a wave of intense mining activities across the world (World Gold Council, 2012).

Ever increasing demand leads to excessive exploration rate on the other hand, the production procedures may be relied on the nature of its existence, shape along with the amount of gold occurrence. Most of the gold exploration techniques are the open pit rather than underground mining. Open cut mining can be regarded as the small-scale or artisanal gold mines (ASGM). For example, in Sijunjung regency, West Sumatra where the research area is located, almost all gold mining can be done by applying open pit method. In the regency, there are both active mining and inactive mining can be found.

Limo Koto VII where the research site is situated, the distract is high prosperity of gold deposit. Therefore, the most agricultural land was completely replaced with mining activities those days. Gold from the study area was extracted by small-scale mining through opencast method. The nature of open pit mining causes soil disturbance which changes storage of carbon as well as nitrogen. Due to the implementation of mining processes in the study area, topsoil was excavated and disrupted. Therefore, the soil structure was adversely damaged for example, top layer went to the lower, then subsoil reached to the surface layer.

The mass destruction of soil structure started to change all the physical, chemical and biological properties of soil. When topsoil has eroded, poor SOM layer (underground soil) comes to the upward with less active biota activities which means a slower rate of residual decomposition.

SOM is one of the most important nutrient drivers, it can be degraded by leaching of Hg through the soil. It can alter the soil's physical properties, especially soil density (Integrated Crop Management, 2002). Throughout the exploration era, Hg was a key factor due to the effectiveness for gold recovery process with reasonable price.

Hg metal is used to extract gold from ore as a stable amalgam in which elemental Hg is frequently added to capture the gold in case of the metal form very fine-grained (Louisa J. Esdaile and Justin M. Chalker, 2018). Then, mercury (Hg) has been widely used in small-scale mining to form Hg-Au amalgam with smaller gold particles, thereby increasing the rate of gold recovery with the aim of separation the impurities from the ore minerals. As a consequence, the chemicals are more likely to be deposited on the soil where the concentration of chemicals may hit the highest in the plant of such area. Accumulation of metals in soil could affect the ecosystem safety and pose a threat to animals, plants, and human (Fazrul and Huda, 2018).

As a result, the area becomes the poor habitats not only for agriculture but also for animal husbandry because of dissolving the toxic Hg in the soil and water. Otherwise, the production process of the study area was ended about ten years ago according to the information of the staff form the environmental department of Sijunjung regency. For this reason, some illegal mining closed to give an example, the study area in which cultivation culture is reinvigorating again, aquaculture along with domesticated animal farming nowadays. The residents apply the several forms of land use among them rice cultivation was played the main role. Other plants namely oil palm is for commercial, citrus, chilly, maize and so on. Such crops are growing with the purpose of self-consumption and selling.

Transboundary characteristics and extremely persistence of Hg can degrade the soil in long periods of time. When the locals ingest such plants from polluted soil, it is easy route to enter the human body. Furthermore, the paddy soil type is more likely to retain Hg for a long time compared to the other soil types. As a result, the soil quality in the study site is able to have high chance of Hg concentration. It is crucially important how much Hg is accumulated in soil around the study area then, is acceptable and untroublesome or not to the public health.

Thereby, the nature of a water-bearing stratum as clayey rich soil which encourages the absorbing Hg through the roots. Owing to the Ombilin River is located next to the research area, it seems to drain elemental Hg directly flow to surface water body. Once the study area became a

paddy filed then normally the best suited of the soil type for paddy is clay which can retain water until the mature stage with the pH range varies between 5.5 - 6.5. Among the soil components, clay can bind large amounts of Hg, partly because of its relatively high surface area (Abollino et al., 2008, Brigatti et al., 2005, Cruz-Guzmán et al., 2006, Lothenbach et al., 1998, Sdiri et al., 2014, Zhong and Wang, 2008a).

If the soil from the surface layer is displaced, there is no plant to reduce the saturation of water around the bare soil. In general, landslide happens after loose soil conditions plus the loss of natural elements in the form of hard plants that have strong roots, where the plant is able to withstand the scouring of rain water (H Widjaja, 2018). As a result, landslides around mines are a common occurrence especially at the large-scale mining where it is usually resulting from a combination of heavy rains and unstable land according to environmental activists whereas mercury pollution is the typical contaminant in the ASGM.

Water contamination is the one of the significant factors when mining operations are as soon as commenced. Artisanal mines often poison waterways with mercury, in turn killing trees and animals that rely on them (NYDF). Obviously, destruction the ecosystem of living organisms especially the group of aquatic biotas due to the discharging the toxic chemical (Hg). For terrestrial plants, the uptake and effects of Hg seems to be plant specific and highly dependent on Hg concentration (Louisa J. Esdaile and Justin M. Chalker, 2018).

Both household water and irrigation water with all purposes of water usage are still consumed from the surface water body near the study site without having any treatment. Hg polluted water can effortlessly travel to the body by drinking and nourishing the aquatic animals. Concerned with this issue, heavy metal related diseases and public health problems have to be faced. In spite of including Hg in water bodies around the research area, necessary to examine Hg level is hygienically safe or lethal effect to the public health.

The mining activities influence community behaviour due to the fusion of indigenous culture with the culture from outside (Mbawo, 2014). Those days, the study was the paddy field before starting the mining operation. However, mass conversion of land use had to be encountered as agricultural land to mining industry. The transformation of land and the scarcity of vegetation area directly impacts on the livelihood pattern of the residences such as farmers to miners. In

comparison with the income of miners and farmers, miners have got the highly satisfied even the minimum wage.

These days, agricultural activities are revitalized after termination of mining as mentioned above. If the dwellers had sound understanding about Hg already, they will be sensible on what matter to eliminate or at least mitigate Hg in the natural resources. Then, the difference between current harvesting rate and past are how to impact on the inhabitants' livelihood. Residents are co-existing with Hg over a decade thus, they might have any knowledge, feeling and or significant problems with respect to consume such toxic element dissolved in the subsistence. These facts have to be measuring tools for individual human wellbeing projected to community wellbeing. The community would prefer environmentally friendly development and the distribution of economic benefits that directly impact their livelihood sustainability (Abdillah & Hamid, 2016).

In addition, Hg is one of the heavy meals and toxic substances, it can introduce the various drawbacks such as public health, Hg accumulation in crops, aquatic animal's survival through soil degradation, water contamination and air pollution. If mercury (Hg) is dissolved in the environment, it can bring the countless negative health issues ranging from mild symptoms to chronic diseases. Mercury (Hg) can be penetrated through the digestive tract and skin. Hg exposure at high levels can harm brain, heart, kidneys, lungs, and immune system of people of all ages (EPA). In domestic animal species, clinical signs of nervous, gastrointestinal, respiratory, and reproductive systems involvement are typical and influenced by the form, dose, and duration of exposure (Barry R. Blakley, 2021).

It can be concluded that all the gold production from the research site was completely finished over a decade, there are the concentration of the mercury waste can be noted as still high accordance with the data of Environmental Department of Sijunjung Regency. Thereby, the study area is threatened under the Hg pollution which is a toxic metal that can cause a variety of adverse health effects depending on the form of Hg (element, inorganic or organic) and pathway, quantity and duration of exposure (Rindi Genesa Hatika et.al 2020).

Using the resources from the polluted area means the people were more likely to have poor understanding or knowledge of severely impact of Hg on the human well-being and environment. For this reason, the study was intentionally commenced for raising the residents' awareness was the most priority over other issues. If they might have enough knowledge or fully aware, they were

no longer to apply those in the future. This research was conducted with the aim of investigating the impacts of Hg solution dissolves in the soil and water which overwhelming the public health and socio-economic criteria. According to the facts mentioned above, the author decided to make the research in this area in spite of the mining activity has been closing since 2012.

B. Formulation of the problem

The author formulates the current problems that are relevant to this thesis, namely:

1. Although mining exploration activities were ceased last ten years, how much concentration of mercury is still existing?
2. What are the social and economic activities of local communities related to this contaminated environment?
3. What are the local communities understanding and perception on this mercury-contaminated environment?

C. Research purposes

Based on the formulation of the problem, the objectives of this research are:

1. To investigate the Hg level in soil along with water after termination of mining process.
2. To identify social and economic activities of local communities related to this contaminated environment.
3. To study the local communities understanding and perception on this mercury-contaminated environment.

D. Benefits of research

The expected benefits or outcomes of this research are:

1. Authorities and residences are able to concentrate the highlighted environmental impacts.

The study is more likely to conserve and preserve the environmental sustainability accordance with the environmentally sound, economically viable and sociably justice through reforming the environment.