別紙４（課程博士）

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Abstract

論文内容の要旨　(博士)

Title of Thesis 博士学位論文名	Mercury Contamination Levels in Small-scale Gold Mining Areas in Indonesia (インドネシアの小規模金採掘地域における水銀汚染)

(Approx. 800 words)

(要旨　1,200 字程度)

Due to the huge number of gold mining in Indonesia, small-scale gold mining becomes popular mining activities carried out using low technology, and applied mercury. This method was practiced by individuals, groups or communities illegally in most areas in Indonesia. Small-scale gold mining became one of the major sources of income. However, mercury exhausted by heating the amalgam was neglected by local people because of this economic reason, and Minamata Disease on 1956 seemed unnecessary problem caused by mercury pollution for the local miners.

Dealing with mercurial gold mining problems, this study was aimed to measure the mercury exposure level in Indonesia, especially in specific regions, such as Central Java and Central Sulawesi. This study monitored the mercury concentration that contaminated environment. Total mercury was measured in waste water, river water, soil, plant, foodstuff and also human hair. This study also addressed to measure the community resilience and community vulnerability to defend with mercury pollution that unavoidable nowadays.

The first study was purposed to measure the community resilience in Cihonje, Central Java, where is the highest gold potential in North Serayu. There was 72 active miners produced tons of gold per year. This was a comparative study of gold mining and non-gold mining areas, using four community vulnerability indicators. Vulnerability indicators were exposure degree, contamination rate, chronic, and acute toxicity. Each indicator used different samples, such as wastewater from gold mining process, river water from Tajum river, human hair samples of people staying in Cihonje (gold mining area), and health questionnaire. For analytical, this research used cold vapour atomic absorption spectrometry to determine total mercury concentration. The result showed that concentration of total mercury was 2420 times higher than the maximum content of mercury permitted in wastewater based on the Indonesian regulation. Moreover, the mercury concentration in river water reached 0.7 ng/ml, exceeding WHO's quality threshold standards. The mercury concentration in hair samples obtained from the people living in the study area (Cihonje) was considered to identify the health quality level of the people or as a chronic toxicity indicator. The highest mercury concentration—i.e.17 ng/mg, was found in the gold mining respondent. Hence, based on the total mercury concentration in the four indicators, the community in the gold mining area (Cihonje) were more vulnerable to mercury than communities in non-gold mining areas.

In another area, Poboya, Central Sulawesi is one of the primary sites used for sm

all-scale gold mining activities in Indonesia too. The total area of Poboya is 7000 hectares. Operating since 2009, Poboya consumes 200-500 kg of mercury/day by am algamation and the indicated spread of mercury Hg(0) is 12 times higher than the WHO standard up to 5 km. Palu, the capital city of Central Sulawesi, is a city with a population of 0.35 million people and located around 11 km away from the edge of a small-scale gold mining area in Poboya. This situation makes Palu mor e susceptible to mercury contamination from gold mining activities in Poboya. Fifte en samples of upper layer soil and fifteen samples of plant (*Calotropis gigantean)* were taken along the road that connects Poboya to Palu, at every 500 m. Mercury concentration in the soil samples showed a gradual decrement as the distance fro m Poboya became greater. The plant samples also revealed a similar trend to the soil samples. The highest concentration of mercury in the soil was found at Poboy a—i.e. 17.62 ng/mg, and the concentration of mercury in *Calotropis gigantean* grow n at Poboya was 6.5 ng/mg. The results illustrated that at a distance of 1.5 km fr om Poboya, the values reached 3 ng/mg and 1.84 ng/mg of mercury in soil and pl ant, respectively. Based on the soil samples and pollution index, the data showed that the Poboya had heavy pollution levels up to 4 km. Moreover, the transfer fac tor was in the range of 0.13-3.44 at distances of 0-4 km, respectively.

Approaching the community vulnerability, in this study area, other two types of sa mple were used; foodstuffs and human hair. Both samples were obtained in Poboy a (gold mining area) and Palu. Twenty-two foodstuff samples were obtained from t raditional markets in Poboya and an additional 22 obtained from Palu. Total merc ury concentration in the collected foodstuffs was in the range of 0.003 to 0.31 ng/ mg from Poboya, and from 0.001 to 0.13 ng/mg from Palu. The results also showe d that the highest total mercury concentration was found in unripe banana, which is frequently consumed by the local people in Poboya. The mercury intake from f oodstuffs, based on a group of people in Poboya for a week, was 180.3 μg/person f rom vegetables, 1.7 μg/person from processed food, 51.4 μg/person from seafood and 17.2 μg/person from meat. In Palu, the results showed 2.9 μg/person/week from v egetables group, 3.1 μg/person/week from processed food, 60.8 μg/person/week from seafood and 12.5 μg/person/week from meat. This condition delineated Poboya as a pollution area arising from mercury contamination. The results showed, dietary fo od intake, with mercury contaminated food, is influential in the results obtained fr om human hair. Where, total mercury in Poboya was 0.3 to 19.6 ng/mg.

However, based on all indicators, it was concluded that the community in gold mining area was more vulnerable to mercury contamination due to small-scale gold mining than the community in non-gold mining area. It risks chronic toxicity for people that exposure of mercury in Indonesia.