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Assessment of Mercury Contaminant in Water of Kahayan River, Tilapia (*Oreochromis niloticus*) and Consumer's Blood in Pahandut Seberang Village Palangka Raya City

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Abstract - Mercury contamination due to Kahayan River illegal gold mining can lead to the bioaccumulation of mercury in Tilapia (*Oreochoromis niloticus*) and consumer bodies as a result of the food chain. The aim of this study was to assess levels of mercury (Hg) in Kahayan River, Tilapia in *keramba* and consumer's blood in Pahandut Seberang Village Palangka Raya City. This research was an analytic observational with cross sectional design study. The study population was water Kahayan River , Tilapia muscle in *keramba* and consumer blood of Tilapia muscle. The water sample, Tilapia muscle sample and blood sample ware nine (9) samples for each. Kahayan River water samples taken at the surface of 500 ml and 2 tails Tilapia for each *keramba*. Blood samples taken Tilapia muscle consumers as much as 3 cc with the criteria of the consumer was , men aged ≥ 20 years , frequency of consumption of Tilapia ≥ 3 times a week and are willing to participate in research. The results showed that mercury (Hg) level in water Kahayan River was < 0,001 mg/l. The mean of mercury (Hg) level in Tilapia muscle was 12,80 ±7,17µg/kg and the mean of mercury (Hg) level in blood consumers was 3,69 ±2,58 µg/l. It is concluded that the mercury (Hg) level in water Kahayan River, Tilapia muscle and blood consumer's are still under the maximum standards.

Index Terms- Mercury in river1, mercury in Tilapia2, mercury in blood3, Kahayan River4

1. INTRODUCTION

Indonesia has the potential of natural resources in mining gold. One of the gold mining contained in the province of Central Kalimantan. Small scale gold mining in the province of Central Kalimantan numerous around Kahayan and Rungan River. Gold mining can lead to mercury contamination in water and soil for the activity using the amalgamation process and causing environmental degradation due washing and panning process conducted in Kahayan.

The results preview studies showed that the levels of mercury in 2004 s.d Kahayan 2007 amounted to 2260 ng/l and exceeded water quality standards in Indonesia[1]. Mercury is a toxic heavy metal compounds that can accumulate in the tissues of living things both in the singular or in the form of compounds[2]. Mercury contamination in water Kahayan can cause bioaccumulation in organisms such as fish or aquatic organisme. Bioaccumulation of mercury in catfish (*Pangasius pangasius*) leads to changes in morphology and cytology in fish organs such as gills , liver and catfish muscle[3] . Most of the mercury in the fish body methylation as a result of the process of bioaccumulation and biomagnification of methyl mercury in the aquatic chain.

Fish accumulates methyl mercury from water and able to convert inorganic mercury to methyl mercury through biometilasi in the body as well[4].

The mercury level in Kahayan River and catfish may indicate that there has been contamination of mercury in the aquatic environment . The heavy metal mercury can be expected to man because man is one part of the food chain. Humans can be exposed to mercury through the consumption of foods such as fish obtained from areas that have been contaminated with mercury[4]. Tilapia (*Orochromis niloticus*) is fish culture in *keramba* in the Kahayan River. The level of consumption of Tilapia is high enough so it become the market share of the results of aquaculture.

Exposure to chemical contamination to humans can be characterized using biomarker examination . Total mercury in hair (THHg) and total mercury in the blood (TBHg) was a biomarker that can be connected to the intake of methylmercury through the consumption of seafood by the general population[5]. Methyl mercury (MeHg) freely distributed throughout the body so that the blood Hg can used as an indicator to estimate exposure to methyl mercury[6].

The purpose of this study was to assess levels of mercury (Hg) in water Kahayan River, Tilapia (*Oreochromis niloticus*) in *keramba* and consumers blood in Pahandut Seberang VillagePalangka Raya City

2. METHODS

This research method was an analytic observational study with cross sectional design. The population in this study was water Kahayan River , Tilapia (*Orochoromis niloticus*) in *keramba* and consumer's blood with a sample size of 9 samples for each population. Kahayan water samples taken in 500 ml of water level in nine *keramb*a . Tilapia muscle samples taken 2 tails for each *keramba* and 3 cc blood of consumers ware taken

3. RESULTS

Mercury (Hg) level on the surface of the water Kahayan River determined using atomic absorption spectrophotometer (AAS). Concentration measurement results can be seen in Table 1.

Tabel 1. Mercury (Hg) Level in water Kahayan River

Sampling Point	CHg (mg/l)	PP No 82 2001 (mg/l)	Statment Official
1	< 0,001	0,001	Qualified
2	< 0,001	0,001	Qualified
3	< 0,001	0,001	Qualified
4	< 0,001	0,001	Qualified
5	< 0,001	0,001	Qualified
6	< 0,001	0,001	Qualified
7	< 0,001	0,001	Qualified
8	< 0,001	0,001	Qualified
9	< 0,001	0,001	Qualified

Table 1 showed that the levels of mercury (Hg) in water Kahayan is < 0,001 mg / l and qualified water quality standards based on Government Regulation No. 82 of 2001 (0,001mg/l).

Sampling of Tilapia muscle in *keramba* performed in 9 locations of the *keramba*. Measurements of mercury (Hg) in the Tilapia muscle using Direct Mercury Analyzer (DMA). The mercury (Hg) level in the Tilapia muscle can be seen in Figure 1. These results indicate that the mercury (Hg) level in the Tilapia is qualified by National Standard of Indonesia SNI 7387 in 2009 (500µg/kg)

Characteristics of consumers of Tilapia muscle in *keramba* can be seen in Table 2

Tabel 2. Charactersitic of Consumer of Tilapia Muscle

Characteristic	(n)	%
Age		
≥ 20 to 39	3	33,3
≥ 40 to 60	6	66,7
Duration Fish Consumption		
≤ 5 year	6	66,7
> 5 years to 10 years	2	22,2
> 10 years to 15 years	1	11,1
Bath Habit		
Exposure	9	100
No exposure	0	0
Source of Dringking Water		
Exposure	4	44,4
No exposure	5	45,6

Mercury level in blood consumer of Tilapia Muscle can be seen in figure 2. Figure 2 showed mercury level in blood consumer of Tilapia muscle under normal concentrations of mercury in the blood standard WHO (5-10µg/l).

4. DISCUSSION

Kahayan is the longest river in Central Kalimantan Province with a length of 600 km , a width of 500 m and has a depth of 7 m. Kahayan be used as a form of livelihood land where gold mining activities without a license and fish farming in *keramba*[7] . Gold mining activities often known as Gold Mining Without Permission or illegal gold mining in Kahayan suspected of causing water pollution Kahayan River for their use of mercury for gold leaching process gold from ore[8].

The mercury (Hg) level in Kahayan River lower than water quality standards under Goverment Regulation No 82 of 2001. The level of mercury is small in Kahayan due Kahayan strong river flow and the effects of dilution. Metal concentrations in the waters constantly changing from time to time as it is influenced by the river flow, waves, rainfall and environmental changes that occurred constantly [9] .

Location illegal gold mining in Kahayan River is done upstream Kahayan which is quite far from the location of water sampling is situated in the central part Kahayan River so the mercury level is smaller than that of gold mining is done on a raft that cause frequent changing locations

Mercury pollution in aquatic environments can adversely affect aquatic organisms. Aquatic organisms that live in aquatic environments are contaminated by mercury can suffer mercury poisoning .

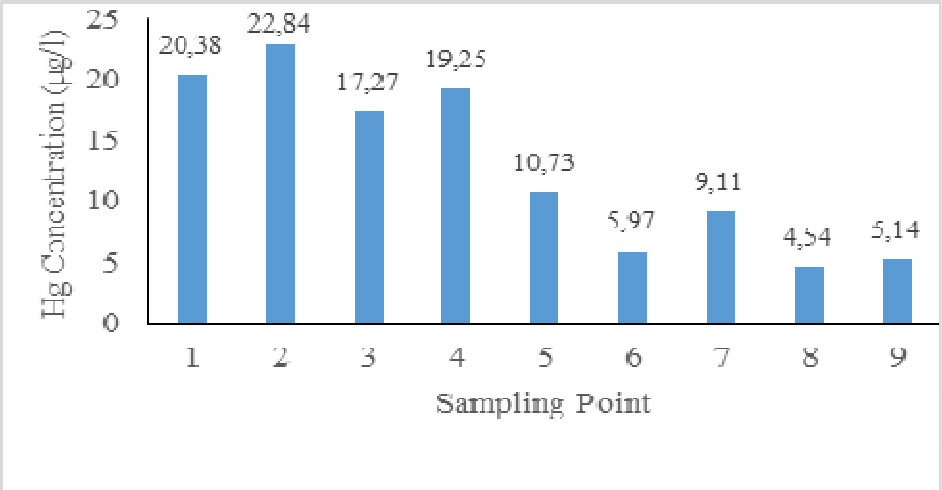

Fig. 1. Mercury (Hg) Levels in Tilapia Muscle in The *Keramba*

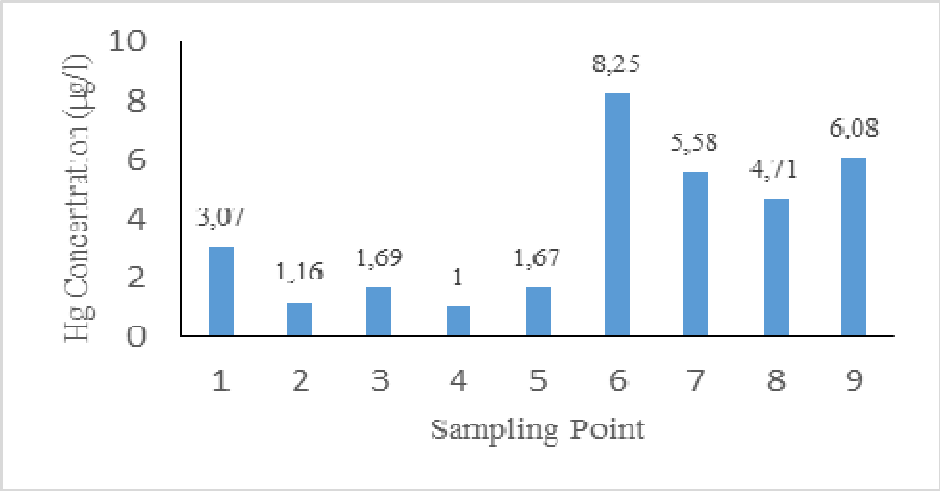

Fig. 2. Mercury (Hg) Levels in Blood Condumer of Tilapia Muscle in The *Keramba*

One or aquatic organismes that can undergo is fish poisoning. Mercury can get into fish tissue through the process of bioaccumulation and biomagnification in the food chain. The mercury (Hg) level in the Tilapia muscle is lower than the limit of heavy metal contamination of mercury (Hg) in food based on National Standard of Indonesia SNI 7387 in 2009. This is because the location of the source of the mercury pollution to Tilapia in *keramba* have long distances so that levels of mercury found in fish smaller. Fish that are not directly contaminated by mercury (Hg) during the growing period have levels of mercury (Hg) at low concentrations. The accumulation of mercury in fish is the highest body found in the blood, and kidneys , brain, liver and muscle [10].

Mercury is an environmental pollutant that causes adverse health impact. Mercury in aquatic environments will be converted into methyl mercury and will enter into the food chain.

Mercury contamination will spread to the highest levels of the food chain through fish consumption [11]. Biomonitoring one very useful method for diagnosing exposure to mercury and control of the levels of exposure[12]. Exposure to chemical contamination to humans can be characterized using biomarker examination. Total mercury in hair (THHg) and total mercury in the blood (TBHg) is a biomarker that can be connected to the intake of methylmercury through the consumption of seafood by the general population [5].

The factors that determine the health effects of mercury include the chemical form of mercury , exposure dose, age of the person exposed, duration of exposure, route of exposure, and feeding habits of fish or seafood consumption [14] .

The level of mercury in the blood of muscle consumers Tilapia in keramba is lower than normal mercury concentrations in the blood by WHO .

The level of mercury found in the consumers blood of Tilapia muscle is not only caused consumption Tilapia in that contain mercury indicated as ≥ 3 times a week but also because consumers use water Kahayan for everyday purposes such as bathing habits and water use Kahayan River as a source of drinking water. Bathing habits and the use of contaminated water as a source of drinking water related with the mercury levels in the community [13] .

Communities that use river water contaminated with high mercury to be consumed as daily necessities tend to have the levels of mercury in them. Exposure pathways of mercury into the human body can be through ingestion . Methyl mercury can quickly be absorbed into the body through the gastrointestinal tract [14].

The Joint FAO/WHO Expert Committe on Food Additives (JECFA) has established provisonal weekly intake (PTWIs) for total mercury at 5 µg/kg body weight and for metylmercury at 1.6 µg/kg body weight. So that, the consumer's of Tilapia muscle must pattern consumption to reduce the accumulation mercury in the body [14].

5. CONCLUSION

a. The mercury (Hg) level in water Kahayan River lower than water quality standards under Goverment Regulation 82 of 2001
b. The mercury (Hg) level in the Tilapia muscle in *keramba* is lower than the maximum limit contamination of mercury (Hg) in food based National Standard of Indonesia SNI 7387 in 2009.
c. The mercury (Hg) level in the consumers blood lower than normal mercury concentrations in the blood standard WHO

6. SUGGESTION

Tilapia muscle consumers should do Tilapia processing by way of immersion using acetic acid as a chelating agent to reduce levels of mercury (Hg) in Tilapia muscle and Tilapia attention to consumption patterns to reduce the accumulation of mercury (Hg) in the body, besides monitoring the levels of mercury (Hg) in the sediment in Kahayan River and monitoring of mercury (Hg) in the Tilapia muscle in *keramba* so as to prevent pollution of mercury in Tilapia

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