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HEAVY METALS CONTAMINATION IN COMMON CARP FISH CULTURE (*Cyprinus carpio*) AT SAGULING RESERVOIR

Etty Riani¹

ABSTRACT

Inland water like river and lake are often received domestic and industrial waste polluting the water. Heavy metals, a part of pollutant substances recorded in inland water will create negative effect to living organisms. Heavy metals may become carcinogenic, mutagenic and teratogenic agent. The aim of this study was to evaluate the heavy metals content in Common Carp (*Cyprinus carpio*) cultured in floating et cages in Saguling Reservoir. The result of the study revealed that Saguling Reservoir was polluted by organic and anorganic substances. Anorganic substances which pollute this Reservoir were heavy metals. Most of Common Carp cultured in the net cages were contaminated by heavy metals, especially in the gill, liver and spleen organs. Heavy metals content in the spleen was higher than that in liver and gills, in the liver it was higher than in the gills. However, the Common Carp flesh was relatively being safe for human consumption.

Keywords: Contamination, pollution, heavy metals, Common Carp, cage culture, gill, liver, spleen, flesh.

INTRODUCTION

Saguling reservoir,, one of cascade reservoir (the first Saguling, the second Cirata and the third Juanda Reservoir), was located in Citarum River Basin, West Java and it elevation is higher than Cirata Reservoir and Juanda Reservoir. The function of Saguling Reservoir are as water resources for Indonesian Regional Water Utility (PDAM), hydroelectric power generator, irrigation (agriculture), fisheries, tourism, transportation, etc.

Nowadays Saguling Reservoir have many problems, not only in this reservoir, but from the outer part, for example replacement of land function in the upper part from the forest area to agricultural area, settlement, industrial, and tourism area,. This reservoir had many cage cultures, so that any part of this reservoir full of cage cultures especially Common Carp, and even they already over reservoir carrying capacity. This reservoir received waste water from various activities like domestic, agricultural, industrial, and commercial activities., thus Saguling Reservoir except many-many waste water from

anthropogenic activities. Waste water contains many pollutants, including organic and inorganic pollutants. The main in organic pollutants in this reservoir is heavy metals like mercury (Hg), lead (Pb), cadmium (Cd) and cromium (Cr) (Riani, 2010).

Heavy metals are metals which have higher density, more than five and are able to get in to and accumulated in the body of organisms, as well as in the aquatic organisms, sediment and water. In organism, heavy metals are able to be accumulated in gill, liver, spleen, kidney, flesh and other organs. Heavy metals pollutant are very dangerous for organisms, but there are few information heavy metals content in organism specially in Saguling Reservoir, thus it is necessary to study heavy metals content in organism, especially in Common Carp (*Cyprinus carpio*), the most common cultured fish in Saguling Reservoir). The aim of this study was to evaluate heavy metals content in fish culture especially in Common Carp (*Cyprinus carpio*).

MATERIALS AND METHOD

This study was carried in three stations at Saguling Reservoir. The Stations were Dam Station, Ciminyak Station, and Batu Jajar Station (Figure 1). On this study, the heavy metals (Hg, Pb, Cd, and Cr) were measured in the water, sediment, as well as in organism. The heavy metals analyses was conducted in the laboratory with the US EPA standard methods by atomic absorption spectrophotometry (AAS).

Reservoir water samples were collected with *Van Dorn* water sampler at all sampling stations and then kept in the cool box. These samples were then acidified with 50 % HNO₃ and kept them into the cool box during transportation to the laboratory for analysis of heavy metals.

Sediment was collected using Eikman grab at all at sampling stations.

All of the sample were put into the sealed clean-plastic bags before putting them into the cool box

The fishes (Common Carp - *Cyprinus carpio*) were collected from cage culture in three station at Saguling Reservoir. The organ/tissue samples (liver, gill, spleen and flesh) were collected from ten fishes for each site sampling. For this purposes, each fishes were dissected by sterilized dissecting apparatus (scissor, scalpel and pincers stainless steel) in the field. The abdomen of fishes was opened (dissected), and then hepatic organ and spleen was collected from this part, as well as gill from the head and flash from the back besides head. The gill was taken from overculum cavity, and the flesh was taken under scale and skin of fish.

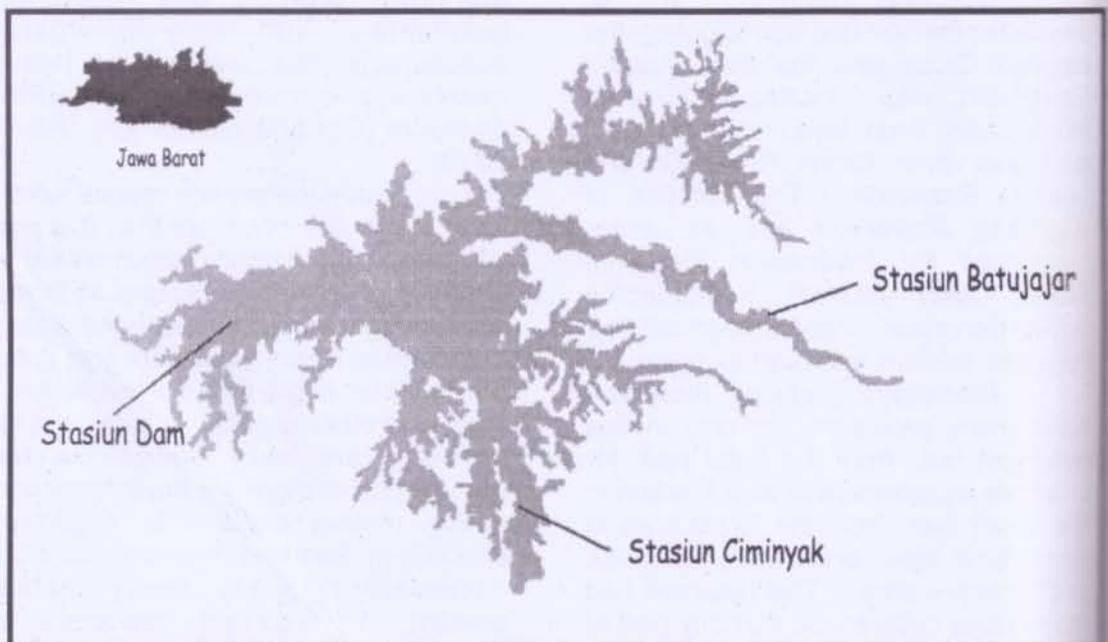


Figure 1. Sampling station at Saguling Reservoir (From: Syaba, 2003).

RESULTS AND DISCUSSION

Heavy metals are metals which have higher density than the standard, more than five and are able to get in to the body or sediment and accumulated

there. Heavy metals can get in to the body of aquatic organism and accumulated there. If the aquatic environment is polluted by heavy metals, this heavy metals are going to

enter their body directly or indirectly. For example, through feeding process, or directly diffusion, etc. This incident can be occurred anywhere, such as in freshwater like reservoir, lake, river, etc; in estuaries, in coastal areas, and in Saguling Reservoir.

The result of this study indicated that the water in all stations were contaminated by heavy metals Hg, Pb, Cd and Cr (Table 1) and their

concentrations already reached the dangerous level, higher than Indonesian guide lines levels No. 82, 2001. This heavy metals were leached out from anthropogenic activities surrounding Saguling Reservoir, especially from industrial activities (Moore & Ramamoorthy, 1984 ; Klaassen, Doull & Amdur 1986).

Table 1. The average of heavy metals concentration in water at every station in Saguling Reservoir (Riani, 2010)

No	Station	Mercury Hg (ppm)	Lead Pb (ppm)	Chrom Cr (ppm)	Cadmium Cd (ppm)
1	Dam	0,013	0,107	0,020	0,020
2	Ciminyak	0,022	0,124	0,023	0,023
3	Batujajar	0,031	0,148	0,035	0,032
4	Indonesian Guidelines Levels, No. 82, 2001				
	Class I	0,001	0,03	0,05	0,01
	Class II	0,002	0,03	0,05	0,01
	Class III	0,002	0,03	0,05	0,01
	Class IV	0,005	1,00	0,01	0,01

Heavy metals Hg, Pb, Cd and Cr can also be accumulated in the sediments since they have high density.. Lead (Pb) content in the water and

sediment was higher than that Hg, Cd and Cr (Table 1 and 2). It could related to its higher concentration in fossil fuels.

Tabel 2. The average of heavy metals concentration in sediments at all of the station in Saguling Reservoir (Riani, 2010)

No	Station	Mercury Hg (ppm)	Lead Pb (ppm)	Chrome Cr (ppm)	Cadmium Cd (ppm)
1	Dam	0,499	8,137	1,008	0,157
2	Ciminyak	1,000	20,14	2,298	0,229
3	Batujajar	1,031	38,18	3,859	0,282
4	Canadian Freshwater sediments guidelines	0,17	35	37,3	0,6

Common Carp cultured in net cages revealed contaminated by heavy metals (Table 3), it value was relatively higher than other's hazard toxic substances. It may be caused directly

by human activities (antropogenic activities) in Saguling reservoir watershed.

Table 3. The average of heavy metals concentration in organ of gold fishes (*Cyprinus carpio*)

No	Sample	Heavy metals concentration (ppm)			
		Lead (Pb)	Chrome(Cr)	Mercury (Hg)	Cadmium (Cd)
1	Spleen	1,360	1,428	1,098	1,488
2	Liver	1,032	1,100	0,998	1,100
3	Gill	0,640	0,705	0,604	0,648
4	Flesh	0,098	0,060	0,042	0,042
	Netherland Guide lines**	0,5	1,0	0,3	0,05

Humans generally consume only the meat part of aquatic organisms, while other parts such as gills, spleen and liver were removed. Common Carp in the study area were cultured in the net cage for human consumption. The foods, including aquatic animals which are consumed should have a good quality standards, food safety, and healthy. This study, showed that the heavy metals content in the flesh was lower than heavy metals concentration permitted in Netherland Guide lines, thus the flesh of Common Carp cultured in the net cage in Saguling Reservoir was relatively safe for human consumption. However, this fish have not been eaten so much y the people lived in surrounding Saguling Reservoir due to their heavy metals content. Heavy metals compound are classified as toxic and dangerous substances for the environment, organism, and human (Klaassen, *et al.*, 1986). This substances will get in to organism directly and indirectly (entering food chain). So that it's going to accumulate in organism and finally it has a very low concentration in water, but it has a very high concentration in organism like fishes (Bryan, 1976 & Mason, 1981, Riani, 2004).

CONCLUSSION AND RECOMMENDATION

Conclusion

- One of the pollution substances in Saguling Reservoir was heavy metal
- Heavy metals in the water was low than in the sediment .
- Common Carp (*Cyprinus carpio*) cultured in net cages cultured in Saguling Reservoir were contaminated by heavy metals
- The contaminated organs were gill, liver and lymph/spleen
- High concentration of heavy recorded in spleen is higher than liver and gill
- The flesh of cultured fishes in cage cultured (gold fish) was relatively safe for human consumption

Recommendation

- There should be information to the aquaculturist and local government to the unsafety of consumption on cultured fish from net cage in Saguling
- There should be law inforcement on waste water treatment to any domestic or industrial activities surrounding Saguling Reservoir and Citarum watershed given by the local government

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