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The content of heavy metal lead (Pb) on baung fish (*Hemibagrus nemurus*) as biomonitoring pollution of Wulan River of Demak Regency

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The content of heavy metal lead (Pb) on baung fish (*Hemibagrus nemurus*) as biomonitoring pollution of Wulan River of Demak Regency

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Abstract. Biomonitoring is the use of a particular species that can provide information related to environmental pollution status by certain heavy metals. Wulan River is the largest river in Demak Regency. The development of population activity along the Wulan River can affect the water quality, because the waste generated from the activities of the population is discharged directly into the river. This study aims to determine the content of lead metal (Pb) in water and meat fish Baung (*Hemibagrus nemurus*) in the waters of the Wulan River. The research method used survey method with purposive sampling. Water and fish samples were collected at 3 stations, Kedungwaru Lor, Pasir, and Berahan Wetan village. Analysis of Pb content using Atomic Absorption Spectrophotometry (AAS) method. The result of the test of lead metal content (Pb) was 0,3189-0,7320 ppm, and the water quality standard of PPRI N0.82 of 2001 class II that is for lead metal is 0,03 ppm. The lead metal content in Baung fish was 2,449-3,920 ppm. Furthermore, it was concluded that Wulan River Demak Regency has medium pollution status.

1. Introduction

Wulan River is the largest river in Demak district. Communities utilize the river as a source of drinking water, agriculture, fisheries, transportation, washing and so forth. In the vicinity of the Wulan River basin is used as residential areas, agricultural activities and industrial areas, industries in the watershed include pulp and paper industry, tofu industry, welding machine, gas station and TPI. These activities mostly dispose of waste in the river. Waste changes physical, chemical and biological factors in the water.

One very dangerous waste is heavy metals. This contaminant if it is above the threshold in a waters can cause ecological unbalance. The number of heavy metal sources in nature, increasing heavy metal pollution especially in waters that will accumulate in the food chain until the biota of waters that have been polluted by heavy metals will experience growth disturbance until death (Notohadiprawiro, 2006). So it needs to get special attention from some parties. To know the pollution by heavy metal that occurred on Wulan River required further inspection effort.

Biomonitoring is the use of a particular species that can provide information related to environmental pollution status by certain heavy metals based on environmental matrix analysis, tissue analysis and molecular organisms exposed to heavy metals (Rumahlatu, 2012). According to Rasyid (2018) bioindicators are organisms or biological responses that show the entry of certain substances in the environment.

Wulan River is widely used by the community, around the river basin is often used for fishing and fishing. One of the many fish found in the Wulan River is Baung fish (*Hemibagrus nemurus*). The fish can be used to monitor environmental pollution. If the Baung fish found in Wulan River accumulates heavy metals such as lead (Pb), it will have a very harmful effect on human health consuming it. The purpose of this research is to know the content of heavy metal of lead (Pb) in water and meat of Baung fish in waters of Wulan River, as well as pollution status of Wulan River.

2. Methods

This research was conducted in Wulan River of Demak Regency, followed by analysis of copper metal content in Wahana Semarang laboratory using AAS method (Atomic Absorption Spectrophotometry) Sampling at Wulan River was conducted in 3 stations was the first station in Kedungwaru Lor Village, second station in Pasir Village and The third station in the village of Berahan Wetan. Each station is divided into 2 substations with three substations each with three repetitions, each of which is randomly assigned, then assigns the code to each station in sampling and prepares the equipment will be used in water sampling and baung fish samples in the waters of the Wulan River.

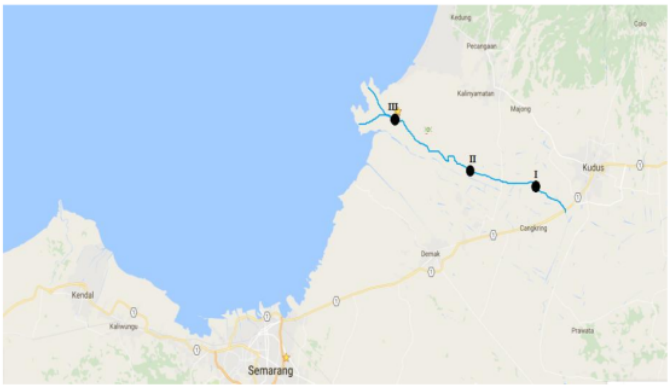

Figure 1. Map of Wulan River

Water sampling from waters of Wulan River using bottles and for sampling Baung fish using fishing rods. Analysis of lead metal content (Pb) in water and meat of Baung fish was done at Wahana Semarang Laboratory using AAS method. Measurements of physical chemistry of aquatic factors include temperature, pH, COD (Chemical Oxygen Demand), BOD (Biochemical Oxygen Demand) and DO (Disolved Oxygen). Analysis of lead metal content data is done descriptively, that is comparing test result of copper metal content with water quality standard of PPRI. 82 Year 2001 class II, while the meat of Baung fish compared with BPOM Number. 03725 / B / SK / VII / 89.

3. Results and discussion

The result of the research at Wulan River and the sample test is done at Wahana Semarang Laboratory, has obtained the result about heavy metal content of Pb in water and Baung fish in waters of Wulan River as follows:

Table 1. Heavy Lead Methane Level (Pb) Water Test in Wulan River in Demak District

Station	Substation	The concentration of heavy metals in river water		
		Average 1	Average 2	Average 3
A	1	0,7320	0,6819	0,6640
	2	0,6525	0,5315	0,6230
B	1	0,5620	0,4929	0,4270
	2	0,4455	0,4910	0,4017

C	1	0,5008	0,4617	0,4455
	2	0,3230	0,3189	0,3702
Quality standards				0,03*

Type:* Government Regulation No. 82/2001

Result of analysis of heavy metal content of lead (Pb) in water in Wulan River waters shows not much different value in each research station that is ranged from 0.3189 ppm to 0.7320 ppm. The highest concentration was found in the first station of one replication substance 1 of 0.7320 ppm, while the lowest concentration was found in the third station of two replication substations 2 that was 0.3189 ppm. Based on the result of the test of heavy metal content of lead (Pb) on all samples of water under study has the concentration of heavy metal of lead that has exceeded the quality standard based on PPRI No. 82 year 2001 for lead is 0.03 ppm. Heavy metal of lead (Pb) was detected in Wulan River flows at all research stations. The highest concentration of leaded heavy metal is found in the first station of one replication station 1, this is because the first station of substation one is closest to the industrial plant and the urban activity that discharges its waste to the river body.

Rudiyanti (2007), stated that in the increasingly distant location of pollutant sources, the content of pollutants will decrease. The lowest concentration of lead metal is found in the third station of two replication substations 2, this is because in addition to this location there is no settlement is also suspected due to the flow of river there are many mangrove trees that have the ability to absorb heavy metals. According to Amin (2001) explains that through its roots, mangrove vegetation can absorb heavy metals found in sediments and ponds.

If we observe the result of the test of heavy metal content of lead (Pb) at Wulan River water at each station has exceeded the quality standard threshold. The presence of heavy metal lead (Pb) in the Wulan River is caused by human activities in the watershed, such as industrial waste disposal, passing fishermen transportation, gas stations, welding workshop, agricultural activities and household waste disposal are also suspected to contribute to pollutants such as metabolic waste and corrosion of water pipes containing Pb. According to Brownea (2009) in Makmur (2013) states that the largest source of lead metal (Pb) comes from human activities, trade, shipping and freight lines and waste generated by the fishery industry.

In some stations there are many fishing boats that produce diesel fuel and the use of paint as a dye on boats that contribute to Pb. This is in accordance with the opinion of Darmono (2006), that materials containing Pb metal in the form of compounds, such as $PbCO_3$ or Pb white and Pb_3O_4 are very useful in the manufacture of paints. Pb metals derived from paint spills and vehicle fuels contain tetramethyl-Pb and tetraethyl compounds that tend to flow through the aquatic bodies.

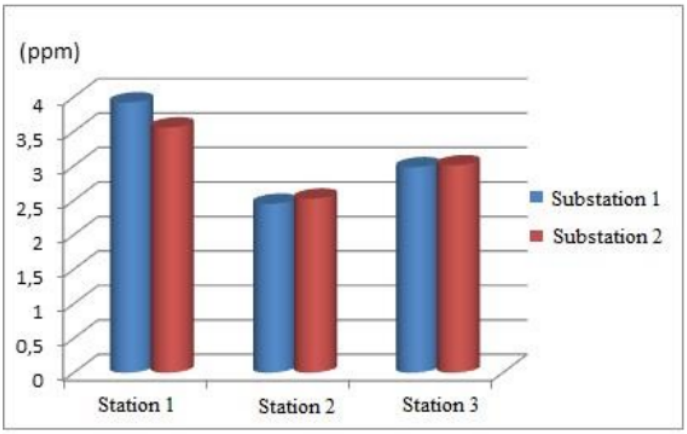

Figure 2. Graph of Heavy Lead Metal Content (Pb) on Baung Fish in Wulan River Waters

The result of heavy metal weight (Pb) contained in baung fish (*Hemibagrus nemurus*) ranged from 2,449 ppm to 3,920 ppm. The highest content is at the first station of substation one that is equal to 3,920 ppm, whereas the lowest content is found on the second station of substtor one that is 2,449 ppm. The content of lead metals accumulated in baung fish in all samples that have been studied has exceeded the maximum limit of heavy metal contamination in food according to BPOM No.03725/B/SK/VII/89 this size of 2.0 ppm. This indicates that the waters of the Wulan river have been contaminated by heavy metals. The high content of heavy metal lead (Pb) in baung fish from Wulan River waters which can be caused by waste of industrial waste pulp and paper, fishing boat activity that produces waste discharges of fuel that can flow to the body of water other than that around the watershed become place Domestic waste disposal by surrounding communities such as tin cans, battery plates and disposable plastics in the water.

Baung fish in Wulan waters can contain heavy metals because heavy metals can enter the body of water biota through the surface of the skin, and through the gills, while heavy metal accumulation in aquatic biota occurs in abductor muscles, gills, mantles, gonads, kidneys and liver (Taftazani, 2007). Furthermore, Darmono (2001) explains that heavy metals enter into the body tissues of living things through several ways, namely the respiratory tract, digestion and penetration through the skin.

Figure 3. Baung Fish (*Hemibagrus nemurus*)

In this research the concentration of lead weight metal (Pb) in Baung fish meat is higher than Pb in water. This is due to the process of accumulation and absorption by the fish against heavy metals from water, where heavy metals will accumulate and stay in the body tissue of Baung fish.

Physical chemical factors also affect the heavy metal fluctuations, so that at the time of sampling need to be seen other parameters of temperature, pH, DO, COD, BOD and the physical condition of the waters to provide an overview of the waters of the Wulan. The temperature at the first station is higher than the other stations so that the heavy metal content in the station has the highest levels of metal, both in water and in Baung fish meat. Higher temperatures will increase the formation of heavy metal ions, thereby increasing the precipitation process resulting in the absorption of heavy metals in sediments (Hutagalung, 1984 in Wulandari, 2009). The lowest pH value is at the first station of one replication station 1. At the station has the highest heavy metals content in both water and in fish meat. According to Hutagalung (1991) in Said (2009) states that a decrease in pH can lead to a greater bioaccumulation of metals.

The result of DO measurements in Wulan River water shows that all measurement stations have exceeded the minimum standard set of 4 mg / l. The solubility of heavy metals is influenced by the dissolved oxygen content. In areas with low oxygen content lower solubility so easily settles (Taftazani, 2007). The result of measurement of BOD content in Wulan River water has exceeded the specified quality standard. Excess BOD content will affect the decrease in dissolved oxygen in these waters and will have a direct impact on increasing the content of COD (Effendi, 2003). The accumulation of heavy metals in aquatic animals is influenced by water contamination in the form of COD (Chemical Oxygen Demand), if COD of water is relatively high, there is a tendency of heavy metal content in water and

sediment will be high, because COD shows non organic content Biodegradable which generally comes from industrial waste (Manahan, 2002 in Sitorus, 2011). The highest concentration of COD in this study is found in stations with the highest weight of heavy metals in water and in Baung fish meat.

4. Conclusion

Based on research done can be concluded that:

1. The results of the test of heavy metal content of lead (Pb) in water in Wulan River waters ranged from 0.3189 ppm to 0.7320 ppm, when compared with PPRI No.82 of 2001 results above the standard quality of 0.03 mg / L (ppm).
2. The result of the test of metal content of (Pb) in Baung Fish meat in Wulan River ranged from 2,449 ppm to 3,920 ppm, compared to BPOM No.03725 / B / SK / VII / 89 the result has exceeded the standard of 2, 0 mg / kg (ppm).
3. Wulan River Kabupaten Demak has medium contamination status.

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