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Heavy Metal Content of Pb and Cu in Wideng Crab (*Episesarma sp.)* in Morosari Water Demak Region

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Abstract. The Morosari estuary area is an estuary area consisting of aquaculture areas, mangrove areas, tourist areas and several large-scale industrial and household activities. This situation causes the entry of waste containing heavy metals (Pb and Cu) into the estuary area. Wideng crab (Episesarma sp.) is one of the biota that lives in the area, and is influenced by the presence of heavy metals (Pb and Cu). This study aims to determine the content of heavy metals Pb and Cu in the mouth of the Morosari River and in the meat of the Wideng Crab (Episesarma sp.). The research was conducted in April – June 2009 and located at the mouth of the Morosari River (Demak). The research method used is descriptive exploratory method, while sampling using purposive random sampling conducted at 3 stations. Sampling of Wideng Crab meat (Episesarma sp.), water and sediment was carried out every 2 weeks as many as 5 samples, and continued with analysis at the Central Laboratory of Kopertis Growth Region IV Semarang. Furthermore, the data obtained were analyzed descriptively. The results of the analysis of the Pb content in water were 0.039 - 0.089 mg/l, and the content in crab meat was 0.175 - 0.335 mg/kg. While the content of Cu in water is 0.024 - 0.055 mg/l, and in crab meat 0.032 - 0.16 mg/kg. The value of heavy metal content in water has exceeded the quality standard threshold allowed by the Ministry of Environment Number 51 of 2004.

Keywords: Cu, morosari, Pb, sediment, water, wideng crab

I. INTRODUCTION

Along the Morosari River basin is used as a residential area and there are fishing activities and industrial areas. Most of the industries in the area have waste in the form of heavy metals derived from painting furniture, canning, beverage industry, printing, which produces Pb and Cu metals. However, some types of biotas can adapt and maintain their survival. One of the biotas that can adapt and maintain their survival is The Wideng Crab (*Episesarma* sp.). Heavy metals cause negative effects in life life such as interfering with chemical reactions, barriers absorption of essential nutrients that are not recommended by the body world health (WHO).[8].

Consider the potential content of wastes that will harm aquatic ecosystems and surrounding communities, it is necessary to research to determine the content of heavy metals in the Morosari River. Morosari Beach area in Demak region is a coastal area with a mangrove ecosystem that has been converted into an encroachment area. Morosari Beach is flanked by two rivers, namely the Morosari River and Bulusan River. Although it has been converted into an encroachment area, there is still a small part of the mangrove area, which is dominated by Avicennia sp. and Rhizophora sp. Wideng crab (*Episesarma* sp.) as pond pests live in mangrove areas, and their existence occurs throughout the year with peak populations occurring at the beginning of the rainy season and the end of the rainy season.

Monitoring of heavy metal pollution in the waters of the Morosari River is carried out by analyzing the content of heavy metals of wideng crab meat, water, and sediment where the biota live. The data obtained after the analysis can be used for the assessment of the water condition of the Morosari River. The purpose of this study is to find out the content of heavy metals Pb and Cu, in wideng crab (*Episesarma* sp.) meat, water, and sediment in Morosari River, Sayung Subdistrict, Demak. The results can be used

as information about the content of heavy metals Pb and Cu in wideng crab (*Episesarma* sp.) meat, water, and sediment.

II. RESEARCH METHOD

The material used in this study is wideng crab (*Episesarma* sp.) meat, which is obtained from the waters of Morosari Beach. Sampling is also measured by environmental parameters including temperature, salinity, pH, dissolved oxygen, and water brightness.

The research method used is an explorative descriptive method, which is research that is intended to interpret the events presented systematically, factual, and accurate regarding the factors and properties of populations in a particular area [13]. In addition, the purposive random sampling method is used, namely sampling of a population randomly by paying attention to the characteristics or properties of the population and environmental factors that are known before achieving a certain specific purpose [6].

Sampling is conducted at three stations (Fig. 1). Station 1 was chosen on the Morosari River because it is affected by waste from the transportation of tourism activities. At this station samples were taken at the mouth of the Morosari River, considering the area was more influenced by seawater. Station 2 is in the encroachment area between the Morosari River and Bulusan River. Station 3 in the Pandansari River area, with consideration of the area, is more influenced by muddy estuary conditions, seawater and mangrove type Rhizophora sp. and Avicennia sp. which is quite dense.

At each station 50 wideng crabs are captured, which is conducted every two weeks. Sampling was conducted on April 26th, May 10th, May 24th, and June 7th, and June 21st 2009. Wideng crab meat was taken and then analyzed the content of heavy metals. In addition, measurements of physical parameters, aquatic chemistry include: temperature, salinity, water quality is conducted in situ at the time of sampling at each research station.

Heavy metal analysis procedure consists of the analysis of wideng crab meat, and water. The method used is a method of testing heavy metal content in accordance with The Indonesian National Standard.[2]

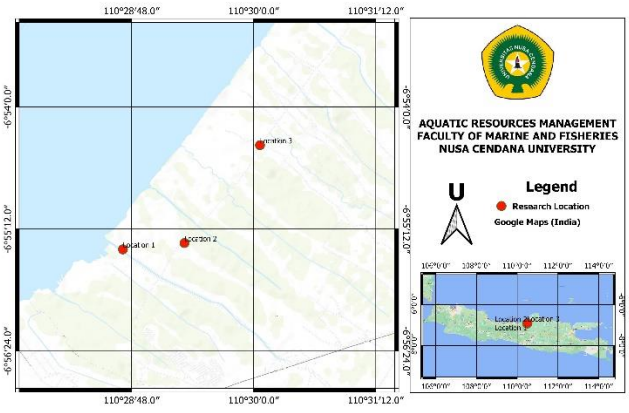

Fig. 1. Research Location

III. RESULT AND DISCUSSION

Heavy Metal Content of Pb and Cu in Wideng Crab Meat

Observations of Pb heavy metal content in wideng crab meat (*Episesarma* sp.) showed the lowest average value of 0.220±0.045 mg/kg research location from three station , while the highest value was averaged at 0.269±0.040 mg/kg sample from Station 2. Furthermore, based on the observation time, the lowest value of Pb content in wideng crab meat (*Episesarma* sp.) amounted to 0.175 mg/kg sampling results on April 26th 2009, while the highest value was 0.335 mg/kg from the sampling on May 10th 2009. While the average content of heavy metal Pb in wideng crab meat (*Episesarma* sp.) amounted to 0.244±0.047 mg/kg (Table I). Cu heavy metal content in wideng crab meat (*Episesarma* sp.) was lowest at 0.067±0.023 mg/kg, found at Station 1, while the highest value was found at 0.105±0.040 mg/kg, found at Station 3. The lowest value of heavy metal content Cu of 0.032 mg/kg is the result of sampling on June 21st 2009, while the highest value was found at 0.16 mg/kg, which was found sampling on April 26th 2009. While the highest value of 0.335 mg/kg from the sampling results on May 10th 2009. The average yield of heavy metal Cu in wideng crab meat (*Episesarma* sp.) was 0.084±0.035 mg/kg (Table II).

Maximum limit of Pb content based on SNI [10] is 0.5 mg/kg. This matter shows that the crabs found in three stations (S-1, S-2 and S-3) are still safe for consumed. So if the Pb content in crab 1 ppm means that in 1 kg of crab there is 1 mg of Pb [1]. while the maximum limit for Cu content is based on SNI [10] is 20 mg/kg. This matter shows that the crabs found in three stations (S-1, S-2 and S-3) are still safe for consumed. These results showed that wideng crabs captured in the encroachment area experienced an accumulation of Pb and Cu metals obtained from the encroachment environment, either directly through predators and digestion or indirectly through metabolism and skin change. The results of [15] also showed that the concentration of heavy metals Cu (0.003± 0.19 mg/kg) and Pb (0.030 ± 0.00) mg/kg in the body tissue of *Pelagicus portunus* crabs in Ennore, India was below the threshold level associated with toxicology.

As it is known that the period of skin turnover is a weak and critical time where heavy metal intake occurs easily [4]. This situation can occur because the irrigation system in the encroachment is done by utilizing the tide and disposing of it at low tide. The tide will stay up to 15 to 30 days following the water replacement calendar that follows the tidal cycle.

At the same time, two estuaries of the Morosari River and Pandansari River is a waste disposal area of several industries and household activities. This waste, which contains Pb and Cu metals, is carried by the current to the aquaculture irrigation system. [14]. The water in the pond, where Pb and Cu metal is contained in it, is the medium of life of wideng crab. While the lower content of Pb and Cu in wideng crab meat captured at Station 1 at Morosari River is related to the tidal washing system because the

estuary is relatively more close and heavily affected by freshwater. This is explained by [7] which states that the intake of heavy metals by organisms begins with rapid absorption of cell membranes, followed by the rate at which the retrieval is taken diffusional and then bound by proteins, either through the process of food digestion or skin change [3].

Heavy Metal Content of Pb and Cu in Water

Observations of Pb heavy metal content in water showed an average low of 0.053±0.012 mg/l sampling results from Station 2, while the highest value was averaged at 0.067±0.011 mg/l from Station 1. The lowest Pb content in water based on observation time was 0.039 mg/l sampling on June 21st 2009, and the highest value was 0.089 mg/l from the sampling on May 24th 2009. The average yield of Pb heavy metal content in water was 0.060±0.014 mg/l (Table III).

Cu heavy metal content in the water was the lowest at 0.033±0.079 mg/l, found at Station 1, while the highest value was found at 0.048±0.007 mg/l, found at Station 3. The lowest value of heavy metal content Cu of 0.024 mg/l is the result of sampling on April 26th 2009, while the highest value was found at 0.055 mg/l, which was found sampling on May 10th, May 24th, and June 7th 2009. The average yield of heavy metal Cu in water was 0.040±0.009 mg/l (Table IV)

Pb and Cu metal content in the water around Morosari River, pond, and Pandansari River, allegedly because it comes from human activity on land. These wastes are the result of industrial waste, household waste and ports, namely the berthing of fishing boats and as a transportation route. [5] Pb and Cu heavy metals are produced from the activities of these ships. The heavy metals are also produced by industries around the river's estuaries, such as furniture painting, canning, beverage industry, printing, which produces Pb and Cu metals, from their waste. [11] stated that some cases of pollution indicate the release of heavy metals derived from human activity is much greater than that produced through natural processes. [12] stated that with heavy metal contamination in water bodies at concentration certain functions can change to source of poison for aquatic life. Even though the poison inflicted by one type of heavy metal against all aquatic organisms are not the same, however extinction of one group can break the food chain life.

Conclusion

Based on the results of research on the content of heavy metals Pb and Cu in the waters of the Morosari River, it can be concluded that the content of heavy metals in water in general has exceeded the threshold value of the quality standard allowed by the Ministry of Environment No. 51 of 2004 [9] while the content of heavy metals Pb and Cu in Wideng crab meat is still safe for consumption based on SNI (BSN, 2011). [10]

REFERENCES

[1] Anonymous, 2010, Atomic Absorption Spectrophotometry Cookbook, Section 3, Shimadzu Corporation, Japan.
[2] [BSN] National Standardization Agency. Indonesian National Standard (SNI 01-2896-1992) ICS 67,040. About how to test metals in food. Jakarta.
[3] Connell, D.W. and Miller, G.J. 1995. Chemical and Ecotoxicology of Pollution. (translation: Koestoer, Y. R. H). UI – Press. Jakarta. 520 pp.
[4] Darmono. 2001. Environment and Pollution, Relationship with Toxicology of Metal Compounds. Publisher University of Indonesia, Jakarta.179 p.
[5] Effendi, H. 2003. Study of Water Quality for Management of Aquatic Resources and Environment. Canisius: Yogyakarta.
[6] Hadi, S. 1979. Research Methodology II. Publishing Foundation of the Faculty of Psychology. UGM. Yogyakarta
[7] Hananingtyas, I. 2017. Study of Contamination of Heavy Metal Content of Lead (Pb) and Cadmium (Cd) in Tuna (Euthynnus sp.) on the North Coast of Java. 1(2) : 2580-5029
[8] Liantira., M. Litaay and E. Soekendarsi. 2015. Comparison of Heavy Metal Content of Copper (Cu) Snail Mas Pomacea Canaliculata at Various Locations in Makassar City. Hasanundin University, Makassar.
[9] MENLH. 2004. Decree of the State Minister for the Environment. Number 51 of 2004. Regarding Guidelines for Seawater Quality Standards. Jakarta
[10] National Standardization Body. 2011. Determination of Pb and Cu Heavy Metal Levels in live crab (Scylla serrata) for consumption. SNI. No. 4108.1:2011. National Standardization Body. Jakarta.
[11] Palar, H. 1994. Heavy Metal Pollution and Toxicology. Publisher P.T. Rineka Cipta. Jakarta. 152 pp.
[12] Palar, H. 2008. Heavy Metal Pollution and Toxicology. PT. Rineka Cipta. Jakarta. 61-71 pp.
[13] Suryabrata, S. 1991. Research Methods. Rajawali Press. Jakarta. 13 pages
[14] Saraswati, SA, Boikh I Lebrina. 2021. Pb and Cu Heavy Metal Content in Sediments in Morosari Demak Waters
[15] Viswanathan, C., Ramakrishnan, A.R., Selvanayagam, M., and Raffi, S 2013. Heavy metal levels in different tissues of the Blue Swimming crab (Portunus pelagicus, Portunidae) collected from Ennore Estuary. International Journal of Research in Fisheries and Aquaculture, 3(1): 1-6.

TABLE I

PB METAL CONTENT ON WIDENG CRAB MEAT (MG/KG)

Date	Station 1	Station 2	Station 3	Averages
April 26th	0.240	0.289	0.175	0.234
May 10th	0.335	0.310	0.204	0.283
May 24th	0.215	0.290	0.267	0.257
June 7th	0.233	0.248	0.270	0.250
June 21st	0.197	0.210	0.186	0.197
Averages	0.244	0.269	0.220	0.244
SD	0.053	0.040	0.045	0.047

TABLE II

CU METAL CONTENT ON WIDENG CRAB MEAT (MG/KG)

Date	Station 1	Station 2	Station 3	Averages
April 26th	0.089	0.133	0.16	0.127
May 10th	0.055	0.109	0.135	0.099
May 24th	0.087	0.065	0.092	0.081
June 7th	0.073	0.055	0.072	0.066
June 21st	0.032	0.049	0.068	0.049
Averages	0.067	0.082	0.105	0.084
SD	0.023	0.036	0.040	0.035

TABLE III

PB METAL CONTENT IN WATER (MG/L)

Date	Station 1	Station 2	Station 3	Averages
April 26th	0.066	0.049	0.058	0.057
May 10th	0.072	0.059	0.042	0.057
May 24th	0.083	0.071	0.089	0.081
June 7th	0.065	0.05	0.069	0.061
June 21st	0.051	0.039	0.044	0.044
Averages	0.067	0.053	0.060	0.060
SD	0.011	0.012	0.019	0.014

TABLE IV

CU METAL CONTENT IN WATER (MG/L)

Date	Station 1	Station 2	Station 3	Averages
April 26th	0.024	0.038	0.047	0.036
May 10th	0.034	0.041	0.055	0.043
May 24th	0.044	0.029	0.037	0.036
June 7th	0.038	0.055	0.046	0.046
June 21st	0.028	0.034	0.055	0.039
Averages	0.033	0.039	0.048	0.040
SD	0.007	0.009	0.007	0.009

TABLE V

MEASUREMENT OF WATER QUALITY

Station	Brightness (cm)	Salinity (ppm)	Temperature (ºC)	DO (mg/l)	Acidity (pH)
		April 26th			
Station 1	63.17	7.33	28.30	2.12	7.3
Station 2	29.67	32.67	29.63	2.56	7.6
Station 3	27.33	34.00	29.67	2.52	7.0
		May 10th			
Station 1	63.12	12.00	28.00	2.03	7.0
Station 2	29.67	31.67	28.20	2.46	7.3
Station 3	27.33	33.67	28.27	2.38	7.0
		May 24th			
Station 1	63.83	16.67	27.97	2.12	7.3
Station 2	75.33	31.00	28.70	3.18	7.6
Station 3	52.33	32.33	29.00	3.73	7.3
		June 7th			
Station 1	72.00	24.33	27.33	3.29	7.0
Station 2	67.67	32.67	27.80	3.39	7.6
Station 3	52.67	33.67	29.47	3.51	7.0
		June 21st			
Station 1	63.00	18.67	25.87	3.76	7.3
Station 2	55.30	33.67	26.90	4.32	7.6
Station 3	51.67	33.67	26.50	4.45	7.3