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The Interconnection of Tambakrejo Community's Lifestyle with Heavy Metal Content in Green Mussels (*Perna viridis*) along the North Coast of Semarang

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Abstract. With the current environmental conditions in the Tambakrejo community, there is a strong interconnection between the levels of heavy metal content in green mussels found in river estuaries and the northern coast of Semarang. The heavy metal content of iron (Fe) in water, sediment, and green mussels (Perna viridis) in the waters of Tanjung Emas, Semarang has been studied in the Journal of Tropical Marine Sciences. These points of contamination result in an interconnection between the lifestyle of the Tambakrejo residents and the heavy metal content in the green mussels consumed by the community. The heavy metal content of Fe in sediments was found to be higher than that in water samples at all stations. The heavy metal content of Lead (Pb) and Chromium (Cr) in green mussels (Perna viridis) in the waters of Morosari, Sayung, Demak Regency was also studied. Tambakrejo is a village chosen as a representative village to investigate the relationship between the community's lifestyle and the heavy metal content present in green mussels along the northern coast of Tanjung Emas, Semarang.

Key words: *Perna viridis, Logam, Semarang*

INTRODUCTION

Green mussels (Perna viridis) are a favorite delicacy among the community due to their relatively affordable price and delicious taste, making them highly sought after. Semarang, being a city with beaches and a harbor, has several coastal villages located very close to the sea. Coastal villages along the north coast of Semarang, such as Pantura and Tanjung Mas harbor, are rich in marine biodiversity, including Perna viridis.

The management of coastal waste is still a concern, as the general public's lifestyle and its impact on the marine environment are taken into account. Marine organisms will eventually be distributed to the public through the buying and selling process and then consumed. Marine debris refers to solid persistent materials directly or indirectly produced by humans, discarded or left in the sea. The presence of marine debris is increasing, with almost 60-80% of it consisting of plastic waste (Moore et al., 2008).

The community's lifestyle, which treats vacant land along the coastline as a dumping ground for non-biodegradable waste, results in its eventual flow into the sea, disrupting the marine ecosystem. One of the impacts is on the green mussels (Perna veridis) that contain heavy metals above the normal threshold set by the Food and Drug Administration. Most metals such as Fe, Pb, Zn, Al & Cu are easily soluble and highly mobile at pH <5 (Stumn & Morgan, 1996). The pH range of 6.5-7 is considered ideal, as nutrient elements are relatively more available at this pH. However, at low pH, elements such as Al, Mn & Fe become toxic. Iron (Fe) levels above 1 mg/L are considered harmful to aquatic organisms (Moore, 1991).

The management of coastal waste remains a concern, considering the impact of the marine environment on marine organisms. Marine organisms will eventually be distributed to the public through the buying and selling process and then consumed. Marine debris refers to solid persistent materials directly or indirectly produced by humans, discarded or left in the sea. The presence of marine debris is increasing, with almost 60-80% of it consisting of plastic waste (Moore et al., 2008).

The dangers of plastic waste have long-term impacts on life, changes in water pH, reduction of marine habitats, and the occurrence of diseases among coastal residents. Lack of awareness among the community about the importance of preserving the environment is one of the factors contributing to the increasing amount of marine debris. Plastic waste in the environment can undergo size degradation, becoming microplastics. Microplastics have been found to enter and contaminate various types of seafood consumed by humans. Green mussels (Perna viridis) are one of the vulnerable organisms to heavy metal contamination due to their filter-feeding behavior when searching for food (Pratikto, 2013). Furthermore, green mussels are considered sedentary animals with limited movement, making them less likely to avoid pollution. They can also be used as

bioindicators of water quality due to their resilience to contamination (Yaqin et al., 2015).

MATERIALS AND METHODS

The researchers used a qualitative research method, incorporating interview results and literature review to generate descriptive data in the form of written or spoken words, as well as observed behaviors, which played a role in the research. Although the research method used was literature research, it can also be referred to as a literature review. According to Darmalaksana (2020), literature research examines what has been done with the aim of solving problems, essentially involving critical and in-depth examination of relevant literature materials. The study was conducted by benchmarking existing theories that are considered valid in the literature, serving as references for data processing and interpretation.

Primary data sources were obtained from interviews and the analysis of the Tambakrejo community's environment. As Fathon (2006) explains, primary data sources serve as the initial reference material for conducting research. Secondary data, on the other hand, were supported by various scientific sources such as journals, dissertations, theses, field observations, interviews, and documentation techniques for collecting field data and research documentation. Additionally, all the collected data potentially contribute to the key findings of the research (Moleong, 1989:11)..

1. **Interview**
2. **Analyzing and processing data**
3. **Writing an article with references**

RESULTS AND DISCUSSION

The distribution of green mussels (Perna viridis) among the general population is extensive, making it a favorite culinary choice. Semarang is located in the northern coastal region, specifically Tanjung Mas. Green mussels, with their ability to filter all the water content in the coastal area, can have detrimental effects if the water is contaminated. This can lead to an excessive presence of heavy metals, such as iron (Fe), which can cause health issues for consumers.

Tambakrejo serves as a representative village to understand the relationship between the community's lifestyle and the presence of heavy metals in green mussels along the northern coast of Tanjung Emas, Semarang. Marine organisms are influenced by environmental factors, and as filter feeders that absorb a significant amount of seawater, green mussels (Perna viridis) are more susceptible to the accumulation of heavy metals like Fe. Most metals, including

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Fe, Pb, Zn, Al, and Cu, are easily soluble and highly mobile at pH < 5 (Stumn & Morgan, 1996). The ideal pH range is 6.5-7, as it provides a relative abundance of nutrient elements. However, at low pH, elements such as Al, Mn, and Fe become toxic. Iron (Fe) levels above 1 mg/L are considered harmful to aquatic organisms (Moore, 1991).

The current environmental conditions in the Tambakrejo community have a strong interconnectedness with the presence of heavy metals in green mussels found in river mouths and the northern coastal areas of Semarang. This is in line with the analysis of the average levels of heavy metals, including Fe, in water samples, sediments, and green mussels (Perna viridis) in the waters of Tanjung Emas, Semarang. According to Supriyantini (2015), the average data results are as follows:

Location	Fe Metal Content			
	November		Desember	
	Water	Mussels	Water	Mussels
River estuary	0,371	03,596	0,234	95,963
Pond	0,214	161,430	0,190	84,866

Source: Data from the Analysis of Average Heavy Metal Content of Fe in Water, Sediment, and Green Mussels (Perna viridis) in the Waters of Tanjung Emas, Semarang. 2015.

The content of heavy metal Fe in sediment at all stations is known to be higher compared to the water samples. This is due to the sedimentation process experienced by the heavy metal Fe. According to the research by Mance (1987), the content of heavy metals in sediment is much higher compared to that in the water column, because heavy metals that enter the water column are absorbed by suspended particles. According to Boehm's opinion (1987), there is a relationship between sediment particle size and organic matter content. In fine sediments, the percentage of organic matter is higher compared to coarse sediments. This is related to the calm environmental conditions, allowing the deposition of mud sediment followed by the accumulation of organic matter at the bottom of the water. On the other hand, in coarse sediments, the organic matter content is lower because finer particles do not settle. Similarly, with pollutants, high levels of pollutants are usually found in fine sediment particles.

Tambakrejo has an environment with several polluted points, where waste management is not yet appropriate, resulting in the accumulation of plastic waste that is sometimes inundated and carried away by seawater in the estuary. Furthermore, tidal waves become another factor in polluting the Tambakrejo area. These points cause

pollution that creates an interconnection between the lifestyle of Tambakrejo residents and the heavy metal content in green mussels consumed by the community.

The content of heavy metal Fe in mussels is higher compared to the content of heavy metal Fe in the water column and sediment. This is suspected because green mussels (P. viridis) have a filter-feeding method of food intake, where they absorb food by filtering sediment into their bodies, allowing continuous intake of heavy metal Fe from the sediment into the green mussel's body (P. viridis), resulting in the accumulation of heavy metal Fe in their bodies. According to Ward et al. (1986), the metals present in biota correspond to the metal concentrations in their environment. Darmono (2001) stated that the difference between mussels and other organisms is that mussels are capable of accumulating larger amounts of metals compared to other aquatic animals due to their sedentary nature, slow ability to avoid pollution, and high tolerance to heavy metal concentrations.

CONCLUSION

The connection between the lifestyle of Tambakrejo residents and the content of Fe in green mussels can be seen from the results showing that the content of Fe in green mussels (Perna viridis) is higher compared to the water content. This is due to pollution caused by the lifestyle of Tambakrejo residents, who still dispose of waste and have not paid sufficient attention to the environmental cleanliness.

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