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The Content of Lead Metals in Water and Green Shells (*Perna viridis*) in the Waters of Tanjung Emas Semarang

Kandungan Logam Timbal dalam Air dan Kerang Hijau (*Perna viridis*) di Perairan Tanjung Emas Semarang

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INTISARI

Perairan Tanjung Emas merupakan daerah pesisir di Kota Semarang yang merupakan daerah produktif dan memiliki potensi sumber daya untuk pembangunan negara di bidang ekonomi. Keberadaan aktivitas industri dan pelabuhan di perairan Tanjung Emas Semarang diduga menjadi kontributor masuknya logam berat seperti Timbal (Pb) ke dalam air. Perubahan lingkungan air yang tercemar akan memengaruhi kelangsungan hidup kerang, karena hewan-hewan ini memiliki mobilitas terbatas dan mudah terpengaruh oleh keberadaan polutan, baik polutan fisik maupun organik. Perairan Pelabuhan Tanjung Emas Semarang berfungsi sebagai tempat budidaya ikan dan budidaya kerang. Salah satunya adalah kerang hijau (Perna viridis). Kerang termasuk jenis hewan penyaring (filter feeder). Sampel air dan cangkang hijau (Perna viridis) yang diekstraksi diukur kandungan timbal (Pb) menggunakan alat AAS (Atomic Absorption Spectrophotometer) yang mengacu pada SNI 6989.4.2009 untuk air dan SNI 01.2896.1998 untuk cangkang hijau (Perna viridis). Hasil penelitian ini menemukan bahwa konsentrasi logam berat dalam cangkang lebih tinggi daripada dalam air. Hasil pengukuran logam berat timbal (Pb) dalam air berkisar antara 0,008 hingga
0,010 mg/l sedangkan nilai dalam cangkang hijau (Perna viridis) berkisar antara 0,274 hingga 0,320 mg/kg. Kemudian untuk parameter kualitas air, nilai pH berkisar antara 7 hingga 7,7 sedangkan nilai suhu adalah 28,6 - 29,8°C dan nilai oksigen terlarut (DO) adalah 5 - 5,2 ppm.

Kata kunci : fitokimia, hedonik, probandus, proteksi, maserasi

ABSTRACT

Tanjung Emas waters are a coastal area in Semarang City which is a productive area and has potential resources for the country's development in the economic field. The existence of industrial activities and ports in the waters of Tanjung Emas Semarang is suspected to be a contributor to the influx of heavy metals such as Lead (Pb) into the waters. Changes in the polluted water environment will affect the survival of shellfish, because these animals have limited mobility and are easily affected by the presence of pollutants, both physical and organic pollutants. The waters of the Port of Tanjung Emas Semarang functioned as a place for fish farming and cultivation of clam. One of them is green shells (*Perna viridis*). Shellfish belong to the type of filter animal (*filter feeder*). Water samples and extracted green shells (*Perna viridis*) were measured for lead content (Pb) using the AAS (Atomic Absorption Spectrophotometer) tool which refers to SNI 6989.4.2009 for water and SNI 01.2896.1998 for green shells (*Perna viridis*). The results of this study found that the concentration of heavy metals in shells was higher than in water. The measurement results of heavy metals lead (Pb) in water ranged from 0.008 to 0.010 mg/l while the values

in green shells (*Perna viridis*) ranged from 0.274 to 0.320 mg/kg Then for water quality parameters the pH value ranges from 7 to 7.7 while the temperature value is 28.6 - 29.8^{o} C and the value of dissolved oxygen (DO) is 5 - 5.2 ppm.

***Keyword*:** Heavy Metal, Pb, Water, Green Shells

INTRODUCTION

Water pollution will degrades the quality and productivity, particulary around the port area where the vessel activities are usually heavy. The pollutan enter the port can be from the pollution, disposal of oil from combustion ballast water and outher garbage (Supriyantini dan Soenardjo, 2015). The existence of industrial and port activities in the waters of Tanjung Emas Semarang is suspected to be a contributor to the influx of heavy metals such as Lead (Pb) and Copper (Cu) into these waters. The concentration of Pb from the river mouth of the West Flood Canal and coastal waters of Semarang City have been previously measured with a concentration of 1.682 ± 0.234 mg/kg (Budiarti *et al.*, 2010). Pollution of lead in the waters of Port of Tanjung Emas in Semarang can be dangerous if consumed by humans, both directly and indirectly. The waters of the Port of Tanjung Emas Semarang functioned as fish farming and cultivation of clam/mussels. Green

mussels (*P. viridis*) are widely consumed by fishermen and local residents, so if the mussels are contaminated with pollutants, the contaminants will enter the human body, in whisch the more mussels are consumed the more possibility that toxic substances will enter the body. Therefore, this research is important to determine the concentration of lead (Pb) in green mussels (*P. viridis*) that live in the waters of Tanjung Emas, Semarang. Mussles is one of the good indicators to monitor an environmental pollution because it is settled in the aquatic environment.

MATERIALS AND METHODS

Time and Place

This research was conducted in the Tanjung Emas Waters of Semarang at 3 stations with the distances between stations was about 1 km. Station 1 is as a fishing village, Station 2 is close to the food processing industry and aquaculture activities, and Station 3 is close to the passenger and goods ports. Each station was determined to3 sampling points as a test. Lead heavy metal (Pb) testing is carried out at the Health Laboratory Office and Medical Equipment Testing in Central Java Province. The parameters measured include the heavy metal lead (Pb) concentration in water and green mussles (*Perna viridis*), and the water quality as a supporting factor, measured were temperature, pH, dissolved oxygen (DO). The data obtain from this research is quantitatively descrbed that is describing the results of the study and analyzing the data obtained in accordance with the research variables.

Sampling Methods

Seawater samples are taken using a 1L volume sample bottle at each station with a depth of 1 m, 10 m away from the shoreline. The water sample was placed in a bottle, then stored in a *coolbox* for further testing. Samples of green shells (*P. viridis*) were taken at a depth of 0-10 cm from each station, and its meat was taken. In this study, all 200 green mussels. They were taken as samples with a size ranged from 5 – 8 cm. Measurement of water quality parameters was done in situ with 4 repetitions at each station following the method (Mokonio *et al.*,2013).

Sample Preparation Of Shells

Meat and bone tissue from green shells (*P. viridis*) were taken as much as 100 g after being mashed with a blender. The sample was put into a plastic bag and stored in a *coolbox* for further processing. Pb

metal concentrations were carried out by the AAS (*Atomic Absorption Spectrophotometer*). Refers to SNI 6989.4.2009 for water and SNI 01.2896.1998 for green shells (*P. viridis*).

RESULTS

Lead Heavy Metal (Pb) Content

The results showed that the lead content (Pb) of water in the waters of Tanjung Emas Semarang differ among stations. The highest Pb concentration in the waterwas found at station 3 and the lowest at station 1. Lead content in green mussels (*P. viridis*) collected at Tanjung Emas Semarang waters was also varies from station to station. The highest concentration of Pb was found at station 3, followed by lower at station 2 and the lowest at station 1 (Figure 4.1)

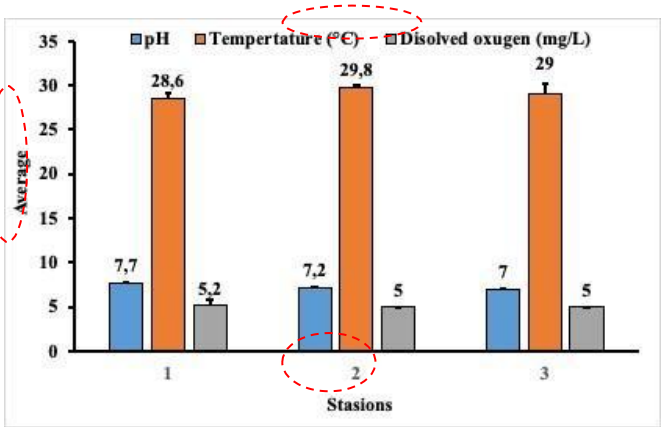

Figure 4.1 Concentrations of pH, Temperature (° C), *Dissolved Oxygen* (DO) of Water in Tanjung Emas Semarang waters

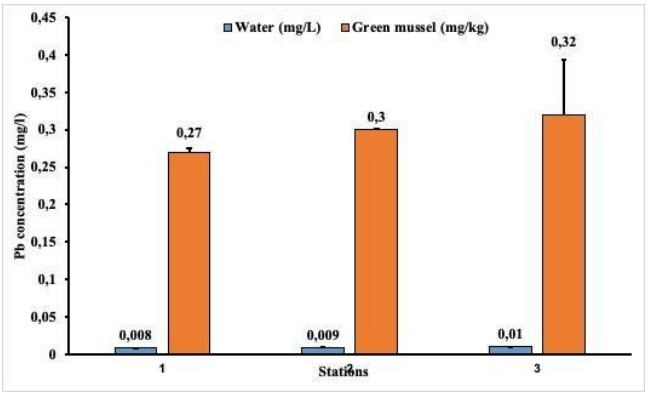

Figure 4.2 Concentration of Lead Heavy Metal (Pb) in Water and Green Shells (*P. viridis*) in Tanjung Emas Waters of Semarang.

Water quality of Tanjung Emas Semarang

Water quality does not differ significantly among stations. It was observed that the activity level at station 1 (7,7) was higher compared to station 2 (7,2) and station 3 (7,0). The temperature at station 2 (29,8° C) was slightly higher than that of station 3 (29° C) and station 1 (28,6° C). *Dissolved oxygen* was relatively similar at the 3 station, ranged between 5,0 – 5,2 ppm (Figure 4.2).

The maximum growth of green mussels was found where the water pH ranges between 6.0 to 8.6 (Sastrawijaya, 2009). The optimum temperature for the growth of green mussles was war ranges between 28-32 °C (Gufran, 2007). The temperature all three staton in ths study were lay between this ranges, therefore the places were suitable for thehabitat of green muscles. The temperature is important for the green muscles as well as the other component, sucas the chemical and biological processes. Higer water temperatures cause decreased levels of O2, but can increase Pb concentration in the water due to the present of Pb in water column in higher water temperature (Yusmania et al., 2016).

DISCUSSION

Lead content in water was found highest at station 3, in line with lead content in green mussels (*P. viridis*). This may related to the area close to the food processing industry is located and near the port, which may affect to higher concentration of lead in the water. The lead concentration limit allowed in seawater for biota according to Indonesian Government regulation (KEPMENLH,2004) is 0.008 mg/l. The result of this research found that the lead concentration in the water at Tanjung Emas, Semarang exceed the threshold of the specified lead quality standard of the Indonesia Givernment Regulation. Referring to the quality standard, the area of Tanjung Emas Semarang waters has exceeded the threshold of the specified quality standard. Rubish and the corrotion of water pipes from the household near the site could affect the lead concentration which has been found contained of Cu, Hg, Pb, Zn, Fe, and Cd (Nanik, 1998.

Green mussels are potential classified as an heavy metal accumulators because of their way feeding as filter feeders. While feeding, the green mussels absorb food containing heavy metal and accumulate it in their body. Sedentary lives animal, such as green mussels, cannot avoid contaminants and have a high tolerance for certain metal concentrations, so they can accumulate (Darmono, 1995).

Similar trend of the lead concentration in the water and in the green mussel, the concentration of lead in the water at station 2 was in line to the concentration of lead in green mussels (*P. viridis*). Station 2 which is located near the fishing village and milkfish ponds may have an effect to the high concentration of lead in water and green mussels. This study found that lead concentration was higher at Station 2 (0.3 mg/l) compared to station 1 (0,27 mg/l). Many other animals lives in this area, particularly those milkfish raised in ponds, may also accumulate lead on their body. The content of heavy metals in waters decreased the diversity of aquatic species and the productivity of aquaculture. In addition, consumption of cultured fish that have been contaminated with lead or heavy metals can cause humans to be exposed to metals (Jarup, 2002).

The lowest heavy metal concentration in the water was found at station 1 as well as in green mussels (*P. viridis*). The location of station 1 is close to the residential area, so the habitat for the green mussels is limited, therefore reduce the population size. Green mussels is known to attach on the hard substrates for a living (Singh *et al.*,2013). The low content of heavy metals found in station 1 may have been affected by water movements such as tides, as well as absorbs by other water ogranism (Kastoro, 1992).

Water quality parameters were not different among stations. Alkaline environment can increase the ability of organism to absorb heavy metals (Bryan, 1976). The degree of toxicity of heavy metals also affected by the pH . The solubility of heavy metals in the water was found higer in low pH, causing greater heavy metal toxicity (Rochyatun dan Razak, 2007; Eshmat (2014). The water temperature was still within the range where the organisms can live. Higher water temperatures result in decrease of dissolved oxygen, therefore have a negative impact to the biotic organisms (Shindu, 2005). Dissolved oxygen is a limiting factor for the organisms to live in water habitat, and one of a key parameter for determining water pollution (Apriadi, 2005). The concentration of dissolved oxygen in the water can determine the risk of accumulation of heavy metals in water organisms (Salmin, 2005).

KESIMPULAN

The concentration of Pb in water and green mussels at Tanjung Emas Semarang was relatively moderate from 0.008 to 0.010 mg/l, whereas in green mussels were 0.274 - 0.320 mg/kg.

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