Aceh Journal of Animal Science (2018) 3(2): 84-88
DOI: 10.13170/ajas.3.2.12622
Printed ISSN 2502-9568 Electronic ISSN 2622-8734

SHORT COMMUNICATION

Lead (Pb) and Cadmium (Cd) contents in mangrove crab *Scylla serrata* collected from several traditional markets in Medan City, Indonesia

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ABSTRAK

Magrove crab *Scylla serrata* lives in coastal area of city is susceptible to contaminate by heavy metals. Therefore, the objective of the present study was to examine the heavy metal content of Lead (Pb) and Cadmium (Cd) in mangrove crab *S. serrata* obtained from several traditional markets in the Medan city, Indonesia. The measurement of heavy metal content was carried out using the Atomic Absorption Spectrophotometer with the Furnace Graph method. The samples were collected from six markets in Medan city i.e. Pancing, Sei Kambing, Petisah, Belawan, Jamin Ginting and Padang Bulan markets. There results showed that the highest value of Pb in was in sample from Pancing (0.025 mg kg^{-1}) and Sei Sikambing (0.025 mg kg^{-1}) Markets and lower was found in sample from Belawan market (0.013 mg kg^{-1}). In addition, the highest Cadmium (Cd) content is in Pancing Market (0.023 mg kg^{-1}) and lower Cd was from Belawan Market (0.101 mg kg^{-1}) . It was concluded that heavy metals Pb and Cd in each sample of mangrove crabs were classified as low level and still met the quality standard threshold. Therefore, the mangrove crab sample is still safe for consumption and can bean export commodity.

Keywords: Mangrove crabs, heavy metals, pollution, AAS

INTRODUCTION

North Sumatra is one of the provinces that has potential in the fisheries sector, and one of the potency is mangrove crab *Scylla serrata*. According to The Ministry of Maritime Affairs and Fisheries (KKP) the mangrove crab production of North Sumatra Province was 26,628 tons in 2008 and it was increased to 33,910 tons in 2012) (WWF Indonesia, 2015). Most of mangrove crab was harvested from wild population in several locations of coastal area near to Medan city the capital of North Sumatra Province. There are many activities carried out around the coastal areas waters of Medan city, such as industrial activities, agriculture, fisheries, ports and domestic activities that potentially contaminate this areas. One of the potential pollutant is heavy metals. Therefore, coastal areas are very susceptible for pollution by heavy metals (Dudani *et al.*, 2017; Almiqrhi, 2018).

According to Supriadi (2016) that the presence of heavy metals in waters or sediment has the negative effect to the aquatic and terrestrial organisms and human life because the heavy metals have the toxic properties and harmful to living organisms. At high concentrations the heavy metals cause death to aquatic biota, while at low concentrations lead to accumulate in the body of the biota (Monsefrad *et al.*, 2012). However, the increasing accumulation of heavy

metals in the body of the biota cause in the biota is not being able to tolerate and ultimately cause death (Prastyo *et al*., 2017).

Lead (Pb) and Cadmium (Cd) are the common heavy metal that polluted the waters and sediment (Hadi *et al*., 2018) than accumulated in aquatic organism such as crabs through food chains and other mechanisms (Sarong *et al*., 2013). The Pb and Cd contents in mangrove crabs *S. serrata* harvested from coastal area of Medan city has not been conducted previously. This harvested crab are usually sold in traditional markets in the city of Medan.

The mud or mangrove crab *S. serrata* is one of the higher value seafood commodities in Indonesia (Muchlisin *et al*., 2006). The crabs can tolerate the extreme environmental conditions especially for salinity and temperature and can adapt to various foods in a variety of habitats (Sara *et al*., 2002), for example; algae, mollusks, worms, bacteria, and detritus. This food items are potentially contaminated by heavy metals from the coastal areas. Mangrove crabs are often used as bioindicators of the waters because this biota often forages on the substrate, have high survival and are usually able to absorb heavy metals in the water (Fitriani, 2017). Study on heavy metals contamination in crabs have been reported in Banyuasin estuaries by Sandro *et al.* (2017) and in Donan River Cilacap (Purnamasari *et al*., 2014), but on crabs harvested from coastal area of Medan City was not examined. Therefore, it is necessary to examine the content level of Lead (Pb) and Cadmium (Cd) in mangrove crab sold in several traditional market in Medan City. This information is useful for determining the safety status of mangrove crab for consumption. Therefore, the aims of the present study was to examine the heavy metal content Lead (Pb) and Cadmium (Cd) in Mangrove Crab *Scylla serrata* collected from traditional markets in Medan.

MATERIAL AND METHODS

Sample Collection

Samples of the crab were collected from 6 traditional markets in Medan City, namely: Padang Bulan, Belawan, Merah, Pancing, Petisah, and Sei Sekambing Markets. The sample was collected from June to September 2018. A total of 2-3 samples were collected from every market. The collected samples were preserved in ice box then transported to Laboratory of Zoology, Universitas Sumatera Utara, Medan for further analysis.

Sample Preparation and Analysis

The carapace of the crab was removed then the muscle was taken and blended homogenously. A total of 0.5 g of sample was taken and then dried in the furnace for 30 min. The temperature was increased gradually 30 min interval from 100 ^{o}C to 450 ^{o}C for 18 hours. Then, the sample was removed from the furnace and cooled at room temperature for 60 min. After cooled, 3 drops H_2O and 1 ml HNO_3 at concentration of 65% were added into the sample then steamed at hot plate at temperature of 100 ^{o}C until dried. Then, the dried sample was moved into the furnace at temperature of 450^{o} C for 3 hours.

After the ash is formed thoroughly, a total of 5 ml of 5M HCl was added into the sample then steamed on a hotplate at 100 ^{O}C until dry. After dried, a total of 10 ml of 0.1 $MHNO_3$ was added and cooled at room temperature for 1 hour. Finally, a total of 50 ml polypropylene was added and then test for heavy metals using the Atomic Absorption Spectrophotography (AAS). This procedure was performed based on Prastyo *et al.* (2017).

Data Analysis

The reading of the calibration curve in the AAS tool uses the following formula:

Cd or Pb concentration (µg/g) = ((D-E) x Fp x V)/ W, where: D is sample concentration (mg/L) from the AAS reading, E is concentration of blank sample (mg/L) from the AAS reading, Fp is the dilution factor, V is the final volume of the prepared sample solution (ml), it was converted into liter prior calculated, W is sample weight(g).

RESULTS

The results showed that the Pb concentration was ranged between 0.016 to 0.025 mg kg^{-1} where the higher concentration was found in sample from Pancing and Sei kambing Markets, and the lowe concentration was in sample from Belawan Market (Table 1). In addition, the Cd concentration ranges from 0.101 to 2.431 mg kg^{-1} where the higher concentration of Pb was found in sample from Pancing Market and lower concentration was in sample from Belawan Market (Table 2). The results of the Pb and Cd heavy metal content analysis in all mangrove crab samples are relatively low and are still carried the quality standard threshold set according to the World Health Organization (WHO).

In testing Lead (Pb), CRM has a value of 0.411 mg/kg and Cadmium (Cd) has a value of 0.282 mg/kg which is used as a comparison of test materials in measurement or testing so that the results can be validated accurately. In addition, in testing Lead (Pb), CRM has a value of0.411 mg/kg and Cadmium (Cd) has a value of 0.282 mg kg^{-1} which is used as a comparison of test materials in measurement or testing so that the results can be validated accurately.

Table 1. The concentration of Heavy Metal Lead (Pb) in Mangrove Crab *Scylla serrata* with Atomic Absorption Spectrophotography

Sample Origin	ABS	Conc. I ($\mu g\ L^{-1}$)	Conc. II ($mg\ kg^{-1}$)	CRM	Certificate
Padang Bulan Market	0.0169	1.608	0.016	0.411	0.404±0.062
Belawan Market	0.0149	1.311	0.013	-	-
Merah Market	0.0176	1.718	0.017	-	-
Pancing Market	0.0228	2.511	0.025	-	-
Petisah Market	0.0162	1.507	0.015	-	-
Sei Kambing Market	0.0229	2.527	0.025	-	-

Note: ABS=Absorbance CRM= Certified Reference Materials

Table 2. Heavy metal concentration of Cadmium (Cd) in Mangrove Crab *Scylla serrata* with Atomic Absorption Spectrophotography

Sample Origin	ABS	Conc. I ($\mu g\ L^{-1}$)	Conc. II ($mg\ kg^{-1}$)	CRM	Certificate
Padang Bulan Market	5.0144	0.3510	2.333	0.023	0.282
Belawan Market	5.0436	0.0395	0.101	0.001	-
Merah Market	5.0321	0.1169	0.502	0.005	-
Pancing Market	5.0034	0.3599	2.431	0.024	-
Petisah Market	5.0246	0.1510	0.703	0.007	-
Sei Kambing Market	5.0203	0.3208	2.022	0.020	-

Note: ABS=Absorbance CRM= Certified Reference Materials

DISCUSSION

The study revealed that the content of Pb is higher than Cd. Probably, this is because of the high concentration of heavy metals that enter the waters. According to Fitriani (2012) that the level of heavy metals are influenced by the amount of heavy metal waste input into the waters, where the higher of the waste enters to the waters resulted in a higher the level of heavy metals in those waters. The Pb and Cd contents in all mangrove crab samples were relatively low and are still carried the quality standard threshold set according to the World Health Organization (WHO) that the Pb maximum limit is 2.0 mg kg^{-1}, and the maximum limit of Cd is 5.0 mg kg^{-1}, while according to the European Union the maximum limit of Pb is 0.5 mg kg^{-1} and the maximum limit of Cd is 0.2 mg kg^{-1}. Therefore, the mangrove crab sample is still safe for consumption. According to Fitriani (2017) that concentrations of heavy metals in biota is influenced by the amount of heavy metal waste input into the waters. The study indicate that the waters where the crab harvested is still in good condition. According to Kasry (1996) that crabs are the aquatic biota which have good adaptability to environmental changes. These crabs are often used as aquatic bioindicators because they can accumulate high enough metals compared to another biota. However, the study showed that the heavy metals concentration in the mangrove was still in the safe level for human.

The heavy metals enter the body tissues of living organisms through several pathways, namely through the respiratory and digestive systems, and penetration through the skin. In the body of animals, the heavy metals is absorbed by blood, then binds to blood proteins which are then distributed to all body tissues. The accumulation rate of heavy metals in the body of an organism depends on its concentration in waters, temperature, species and physiological condition (Mu'nisa and Nurham, 2010) and feeding habits of the animal (Sarong *et al*., 2013). However, the highest metal accumulation is usually in liver and kidney (Arantes *et al*., 2016). Generally the content of heavy metals in water and muscles is usually lower than the sediments. This is due to the heavy metals are non-biodegradable and accumulative compound, hence tend to settle on sediments. The mangrove crabs has a life buried in the mud for hiding or looking for prey such as shellfish, moss and even detrivor. This condition causes crabs to be potentially exposed to heavy metals through mud or food chains. However, the results of this study indicate that the content of Pb and Cd in mangrove crabs sold in several traditional markets in the city of Medan is still safe for consumption.

In general, the Pb concentration in the mangrove crab sample was higher than Cd, this is probably because of the Pb is a non-essential and toxic metal (Irhamni *et al*., 2017), so that the mangrove crab is unable to regulate the Pb and therefore the Pb was accumulated in the tissues. This is in accordance with Darmono (2001) which states that metals that cannot be regulated by aquatic organisms, there will be an increase in the organ of the biota along with the increase in exposure time (Sarong *et al*., 2015).

CONCLUSION

The highest value of Pb content was found in Pancing and Sei Kambing, while, the higher Cd was in Padang Bulan Market. The results of the Pb and Cd heavy metal content analysis in all mangrove crab samples are relatively low and are still carried the quality standard threshold set according to the World Health Organization (WHO) and therefore save for consumption.

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Received: 20 December 2018 Accepted: 31 December 2018