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# Paper 9

*by* Akas Yekti Pulih Asih

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## Levels of Cuprum (Cu) and Plumbum (Pb) in Shrimp in the traditional market and their impacts towards the environmental health

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## Levels of Cuprum (Cu) and Plumbum (Pb) in Shrimp in the traditional market and their impacts towards the environmental health

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**Abstract** Absorption of heavy metals by the main shrimp Cuprum (Cu) and Plumbum (Pb) will be accumulated in the body and cannot be biodegradable and accumulated in living tissue. Cuprum and plumbum in small amounts are needed in the body's metabolic process but exposure in excess amounts is toxic, so that at a certain level it can increase the risk of death. Heavy metal pollution often comes from human activities, namely industrial waste disposal, domestic waste or pesticide use in agricultural cultivation, plantations, as well as fisheries businesses, especially shrimp farming. This study aims to identify the magnitude of the average levels of cuprum (Cu) and plumbum (Pb) heavy metals in various types of shrimp available in traditional markets, by comparing the average levels of cuprum (Cu) and plumbum (Pb) of various types of shrimp, observation as well done by comparing the physical size of shrimp based on the type of shrimp. and determination of cuprum (Cu) and plumbum (Pb) levels was carried out by atomic absorption spectrometry. The results of research on shrimp sold in the traditional market of Surabaya, showed that the smaller the physical shrimp, the higher levels of cuprum (Cu) and plumbum (Pb) will be higher. The highest Cuprum (Cu) and Plumbum (Pb) levels were found in Vannamei (*Litopenaeus vannamei*) shrimp, Cuprum (Cu) levels of 8,811 mgCu / kg, and Plumbum (Pb) of 1,990 mgPb / kg, on Windu shrimp (*Panaeus monodon*) Cuprum (Cu) levels of 7,886 mgCu / kg, and Plumbum (Pb) of 0.735 mgPb / kg, whereas for giant prawns (*Macrobrachium rosenbergii* de Mann) showed levels of Cuprum (Cu) of 5,814 mgCu / kg and Plumbum (Pb) of 0.728 mgPb / kg; this average level is higher than the WHO standard of 0.691 mgCu / kg for Cu, and 0.715 mgPb / kg for Pb.

### 1. Introduction

Consumer demand for various types of fish and crustaceans, including various types of shrimp, continues to increase every year due to the increasing welfare of the people in Indonesia, so that the quality of consumption shrimp for both exports and local communities is increasing [1]. The quality of shrimp must meet the food safety agreed upon by the world community, one of which is heavy metal content [2,3].

The issue of increasing research on heavy metals in the environment is largely due to the level of damage and the very high level of poisoning both directly and indirectly towards living creatures and their environment. A number of chemicals are known to be carcinogenic, especially in humans and animals, for example heavy metals lead (Pb) and copper (Cu), are inorganic compounds dissolved solids [4], such as other heavy metals known as metals that are dangerous if their presence is in the human body or other animal's body including the shrimp exceeds the threshold.



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Basically shrimp culture always requires water in a clean state, but in reality river water and coastal waters are often used directly as a source of water for shrimp culture [5,6], but now many aqir sources which have been contaminated with various types of pollutants, including heavy metals, while the need for shrimp production continues to increase throughout the year, so special treatment is needed on the culture, including the use of chemicals in the form of fertilizers and pesticides given that shrimp are very susceptible to pests and diseases [6]. Now many water sources have been contaminated with various types of pollutants including heavy metals that come from various human activities and come from nature [7]. Cuprum (Cu) and plumbum (Pb) are very toxic heavy metals and many are always present in water at various levels of pollution in the environment [8].

The type of shrimp that is widely found in traditional markets is the Windu shrimp (*Panaeus monodon*); vannamei / white shrimps (*Litopenaeus vannamei*), freshwater shrimp / river shrimp (*Palaemon* Sp); giant prawns (*Macrobrachium rosenbergii* de Mann), grago shrimp or rice shrimp (*Caridina* Sp), rebon shrimp (*Mysis* Sp), api2 shrimp (*Metapeneoues monoceros*). Based on the description above, a research is needed on the content of heavy metals in shrimp that are sold as consumption ingredients in traditional market, considering the effects of heavy metals are very risky to public health. This study aims to compare the average levels of cuprum (Cu) and plumbum (Pb) of various types of shrimp sold in the Surabaya traditional market.

## 2. Literature review

Heavy metals with a certain amount are needed by living creatures as important micronutrient materials. Some marine biota including shrimp are biota that live in the bottom of the sea and have the ability to accumulate heavy metals in their bodies far beyond the concentration in the surrounding waters and are widely used as bio indicators of the presence of heavy metals in the waters [9].

Some heavy metals are important elements because they are needed as a physiological function, but if they are found in food, water or air, they will have a negative impact on health, including being able to adversely affect human health as the end chain of the food chain in the life process. However, some heavy metals are essential micronutrients that are needed for the metabolism of the shrimp body, while some other types do not have a biological (non-essential) role even at very high levels are very deadly [6,10,11]. Crustaceans include crabs, squid and various types of shrimp sold as supplementary ingredients (side dishes, or even often used in certain cultural processes) or just as flavoring ingredients or ingredients that are consumed. it means that shrimp can be consumed directly as a side dish, a mixture of crackers, crackers, or other preserved ingredients.

Because the habitat in the bottom of the water which is a place of sediment from various types of waste, then this type of crustacean is a good bio indicator to determine the occurrence of environmental pollution, this is because many types of crustaceans eat zooplankton and phytoplankton which are widely found at the bottom of the water while accumulating heavy metals originating from aquatic waste [6]. Shrimp is classified as a booster indicator even though every animal in the water always has the ability to do osmoregulation (as an effort to neutralize toxins around the environment), so the ability of animals that live in the waters of one of the shrimp is very dependent on their physical ability to avoid toxins in the environment (waters) or it can be said that the greater the physical shape of the shrimp, the higher the osmoregulation ability [4]. Shrimp (Crustacean) can live in various types of deep sea waters, shallow sea waters (beaches), brackish water (ponds) or even in certain types can live in fresh water (rivers), for example in types of giant prawns (*Macrobrachium rosenbergii* de Mann) during its life cycle requires 2 types of water, namely fresh water for the larval period and brackish water for adults.

Based on the amount of shrimp physics, the biggest successive are giant / congkah shrimp (*Macrobrachium rosenbergii* de Mann), Windu shrimp (*Panaeus monodon*); vannamei shrimp (*Litopenaeus vannamei*), freshwater shrimp / river shrimp (*Palaemon* Sp); grago shrimp or rice shrimp (*Caridina* Sp), rebon shrimp (*Mysis* Sp), api2 shrimp (*Metapeneoues monoceros*).

- The smaller the physical shape of the shrimp, the higher the levels of cuprum (Cu) and plumbum (Pb)

- Vannamei / white shrimps (*Litopenaeus vannamei*), has the highest levels of Cuprum (Cu) and Plumbum (Pb) when compared

### 3. Data and methodology

Based on direct observation, the most consumed shrimp in Surabaya in sequence are as follows:

- Vannamei shrimp (*Litopenaeus vannamei*).
- Tiger Prawn (*Panaeus monodon*)
- Prawns (*Macrobrachium rosenbergii* de Mann)

Determination of cuprum (Cu) and plumbum (Pb) heavy metal content in shrimp was carried out using Spectrometry (AAS), with some beaker 50 ml glassware, 10 ml volumetric flask, 5 ml polyethylene vial, 10-100 µl effendorf micropipette and analytical balance.

The study was conducted in May 2018 in 5 Surabaya traditional markets, the traditional market in question is a market managed by Surabaya regional. Shrimp samples were deliberately chosen by 3 types based on the number of shrimp species available in the market, then the shrimp species were chosen randomly with 150 samples (each market took 10 tails), Sampling is done randomly and intentionally (without distinguishing the condition of the shrimp alive or dead), but it is still chosen that the shrimp can be used as a sample (the shrimp die but not in a rotten state), the sample is taken based on the market area (Surabaya market west, east, south, north and central Surabaya market).

Determination of cuprum (Cu) and plumbum (Pb) heavy metal content in shrimp in Airlangga University Surabaya Biology laboratory. Data calculation is done directly by comparing the average results of cuprum (Cu) and plumbum (Pb) heavy metal levels on various types of shrimp by looking at the small physical body size of each type of shrimp.

### 4. Results and discussion

Based on direct observation in the field, the shrimp available in the traditional market are often available in a dead state (without knowing the cause). This is likely due to environmental pollution, the use of chemicals during cultivation or mismanagement of harvest or even during the sale process (addition of formalin or ingredients others as preservatives. Shrimp is a food commodity very quickly damaged / rotten in just a matter of hours it is also often based on the physical size of the shrimp, so often traders add preservatives (with the amount of uncertain ingredients) in the merchandise without the buyer's knowledge such as the addition of formaldehyde and certain types widely sold in the traditional market / krempyeng market (in Java).

Osmoregulation (shrimp adaptability to the surrounding environment) in the shrimp occurs at any time if the surrounding waters are contaminated by toxins or heavy metals, the greater the physical shape of the shrimp, the greater the osmoregulation power given the shrimp's ability to avoid its environment will greatly depend on shrimp mobility (the greater the physical shape of the shrimp, the greater the ability to avoid).

Based on the type of shrimp by looking at their physical size, the selling price of shrimp in the market is also very different, the bigger the physical shape of the shrimp, the higher the selling price of shrimp so that it will not be bought by the weak economy. based on the type of shrimp sequentially are:

- Vannamei shrimp (*Litopenaeus vannamei*)
- Tiger Prawn (*Panaeus monodon*)
- Prawns (*Macrobrachium rosenbergii* de Mann)

Considering that the need for vannamei shrimp (*Litopenaeus vannamei*) in the community is very high, the fish farmers often make efforts to increase shrimp production in various ways to avoid losses due to shrimp death (efforts to avoid crop failure), for example using chemicals (pesticides and chemical fertilizers). in quantity and relatively high / high intensity), although vannamei shrimp can be directly obtained in shallow sea water, this type of shrimp can also be cultivated in brackish water (pond).



**Table 1.** The average Cu (mg/Kg) based on the type of Shrimp

Shrimp Type	Cu content (mg/kg)					Average
	Market					
	1	2	3	4	5	
Vaname Shrimp	8.377	8.803	8.754	9.053	9.068	8.811
Windu Shrimp	8.390	8.124	8.512	7.106	7.300	7.886
Prawn Shrimp	6.423	5.214	5.832	5.737	5.864	5.814

Source: Results of laboratory analysis

Based on the results of the study it turned out that the average Cuprum (Cu) level was higher than the Plumbum (Pb) levels in each type of shrimp. Likewise, almost every traditional market in Surabaya, it is known that Cu levels are higher than Pb levels in each type of shrimp based on the physical size of shrimp (table, 1). Cuprum (Cu) is a heavy metal that is always present in the waters. Concentration of Cu in the water is not very high [10], in waters the Cu content should not exceed 0.05 mg / L and natural source waters should not exceed 0.1 mg / L [3]. if the Cu content in the waters is very high, the Cu content in the shrimp body is also high.

Whereas heavy metal Plumbum comes from the air as well as various antropogenik and erosion activities. Cu and Pb at high concentrations are xenobiotic (very dangerous for living creatures) and in the body can cause mutagenic and carcinogenic events [6]. In table 2 it can be seen that the average Pb level is lower when compared to Cu levels in all samples taken from traditional markets in Surabaya, even though the high low levels of heavy metals depend on the high and low pollution in the waters.

**Table 2.** The Average Pb (mg/Kg) based on the Type of Shrimp

Shrimp Type	Pb content (mg/kg)					Average
	Market					
	1	2	3	4	5	
Vaname Shrimp	0.160	0.271	0.376	0.075	9.068	1.990
Windu Shrimp	0.542	0.700	0.814	0.519	0.101	0.735
Prawn Shrimp	0.954	0.660	0.804	0.953	1.227	0.728

Source: Results of laboratory analysis

The results showed that the levels of cuprum (Cu) and plumbum (Pb) heavy metals in shrimp sold in the Surabaya traditional market were high on average. in giant prawns (*Macrobrachium rosenbergii* de Mann) showed levels of Cuprum (Cu) of 5,814 mgCu / kg and Plumbum (Pb) of 0.728 mgPb / kg; Windu shrimp (*Panaeus monodon*) levels of Cuprum (Cu) of 7,886 mgCu / kg, and Plumbum (Pb) of 0.735 mgPb / kg, while for Vannamei (*Litopenaeus vannamei*) shrimp, Cuprum (Cu) levels were 8,811 mgCu / kg, and Plumbum (Pb) of 1.990 mgPb / kg. The greater the physical shape of the shrimp, the lower the levels of Cuprum (Cu) and Plumbum (Pb).

## 5. Conclusion

From the results of the study it can be concluded as follows:

- The smaller the physical size of the shrimp, the higher the levels of cuprum (Cu) and plumbum (Pb) metals.
- In the type of shrimp Vannamei (*Litopenaeus vannamei*), the highest levels of cuprum (Cu) and plumbum (Pb), namely the levels of Cuprum (Cu) of 8.881 mgCu / kg, and Plumbum (Pb) of 1.990 mgPb / kg, when compared with tiger shrimp (*Panaeus monodon*) and giant prawns (*Macrobrachium rosenbergii* de Mann) throughout traditional markets in Surabaya.

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