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Analysis Quantities of Cadmium and Lead Heavy Metal in Fish and Water along the Tello River Makassar, Indonesia

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Abstract:

The purpose of this research is to know concentration of content of Cadmium and lead in water and fish along the Tello River in Makassar. This research is descriptive research that is to know the content of Cadmium and Lead in the waters of the Tello River arrived at the Paotere Port of Makassar City. The design of this research is explanatory research to get clarity about the condition of cadmium and lead metals in water, fish organisms and sediments. The research was conducted in May to July 2018. Sampling is done by looking at and guessing the range of locations for cadmium and lead metal contamination, namely upstream and river estuary, settlement areas, river estuaries and industrial locations and areas with a lot of household waste. Data that has been collected and processed is then analyzed by descriptive analysis.

The results showed that cadmium content in fish at the research site showed cadmium is highest at station 1 which is the location near the rice plant which is 0.0244 mg / kg, the highest cadmium content in water at station 5 which is the location around the Makassar Paotere Port is 0.01915 ppm. The concentration of cadmium in water is dangerous according to the Republic of Indonesia Ministry of Health and WHO of 0.01 ppm. Furthermore, the cadmium content in sediments in the five stations shows a number <0.10 mg / kg which can be indicated that sediment in the study site has not been contaminated with cadmium at dangerous limits. The lead content in fish, water and sediment at the research location is highest at station 5, which is the location around the Port of Paotere. For water quality shows the average value of water pH during the research while other stations are below 7, the value of dissolved oxygen is only station 2 with an average value above 5 ppm while the other stations have oxygen values below 5 ppm. Furthermore, the water temperature is still within the desired range of aquatic organisms

Keywords: Cadmium, lead, river, tello, water quality

1. Introduction

Industrial development and increasing human activities, especially along the Tello River flow to the Paotere Port of Makassar now it can spur pollution. At certain concentrations of waste that enters the environment, especially the waters can adversely affect water quality and affect the life of organisms in it.

Waters often polluted by various inorganic components including various types of hazardous heavy metals which are mostly produced from industrial processes. These metals are known can to accumulate in the body of an organism and remain in the body for a long time as a poison (Kristanto, 2002).

If the metal content in the waters rises little by little, then the metal can be absorbed in the body tissues of the organism from the smallest which acts as a producer to the largest organism which acts as consumers of the end of the food chain such as fish, shrimp, shellfish and eventually buried in the tissue of the animal (Murtiani, 2003). Pollution of various types of heavy metals has become a major concern because of the toxicity effects that can be caused. Metal contamination is one of the persistent contaminants and can reduce environmental quality (Souisa *et al.*, 2015).

Pollution by heavy metals can occur in waters, soil and air, but the most dangerous for life is what happens in the waters (Manik, 2007). These metals are known to collect in the body of an organism and remain in the body for long periods of time as accumulated poisons. One of the heavy metals that often contaminates water is lead (Kristanto, 2002). Cadmium and lead are pollutants that are toxic. Bodies of water that contain cadmium and lead compounds or lead can cause the death of aquatic biota if it has exceeded the concentration of these metals (Suharto, 2005).

2. Research Purposes

The aim of this research was to know the concentration of Cadmium and lead heavy metals in waters and fish along the Tello Makassar River.

3. Method

This research is a descriptive research that is to find out the content of Cadmium and Lead on the waters of the Tello River to the Paotere Port of Makassar. The design of this research is explanatory research to get clarity about the condition of cadmium and lead in water, fish organisms and sediments.

Taking the location of the sample is done by looking and guessing range locations for the spread of cadmium and lead metals such as upstream rivers, residential areas, river estuaries and industrial locations and areas with a lot of household waste. Therefore, in this research divided into five observation stations namely Station 1, which is the location near the rice plant, Station 2, which is the location near the residential area, Station 3 is the location of the Tallo River Bridge, Station 4, namely the location of the Tallo River Estuary and Station 5, namely the location of the Port of Paotere. The time of research is conducted from May to July 2018.

The research carried out included preparation of tools, sampling, analysis of samples in the laboratory and analysis of research data. Taking water samples was carried out using a sample bottle of 500 ml. Taking water samples was carried out 5 times during the research at a depth of approximately 50 cm from the surface of the water. Fish sampling was conducted at each station 2 times during the research for five locations by catching fish using gill net or fishing rod which is around the observation station is 1 fish, to be taken to the laboratory for analysis. Sediment samples are taken using paral on pipes at a depth of approximately 20 cm, which is plugged into the sediments at each sampling station. All samples that have been taken, then below to the laboratory to analyze cadmium and lead content. Data that has been collected and processed is then analyzed by descriptive analysis.

4. Results and Discussion

4.1. Cadmium

4.1.1. Cadmium of Fish

The heavy metal content of cadmium fish in the research location can be seen in Figure 1. In Figure 1 shows the highest fish cadmium in the research location is at station 1 which is the location near the rice plant is 0.0244 mg/kg, following station 2 which is a location near a residential area is 0.01675 mg/kg, station 3 which is a location near the Tallo Bridge is 0.01215 mg/kg, station 4 which is the estuary of the Tallo River is 0.00855 mg/kg and the lowest at station 5 is the location around the port of Paotere, Makassar is 0.00315 mg/kg. This means that cadmium heavy metal is at station 5 which is the location around the Port of Paotere has not accumulated into the body of the fish, compared to the content of cadmium in water (Figure 2).

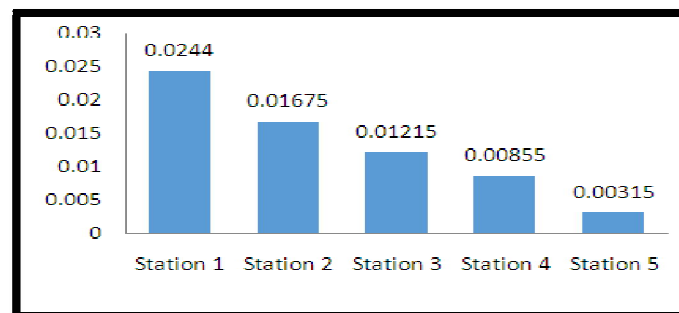


Figure 1: Cadmium of Fish Content at the Research Site

4.1.2. Cadmium of Water

The content of heavy metal cadmium in water at the research site can be seen in Figure 2. In Figure 2 shows the highest cadmium content in water at station 5 which is the location around the Makassar Paotere port is 0.01915 ppm, following station 4 which is a location around the estuary of the Tallo river that is equal is 0.01715 ppm, station 3 is 0.01425 ppm, station 2 is 0.01165 ppm and the lowest is at station 1, which is the location of rice planting is 0.0077.

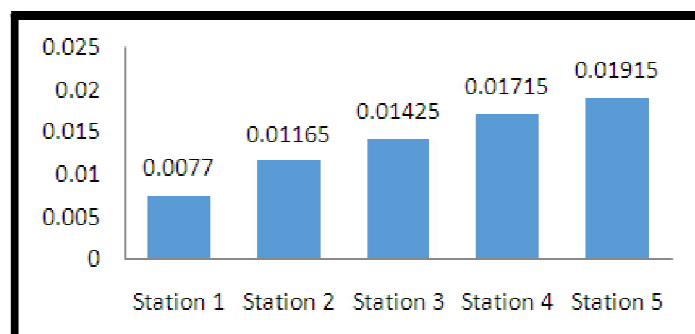


Figure 2: Cadmium of Water Content at the Research Site

Thus it can be said that the farther from the Port of Paotere, the lower the value of cadmium in water, which also means that water is increasingly free of cadmium metal. Furthermore, the maximum standard concentration allowed for cadmium in water according to the Indonesian Ministry of Health and WHO is 0.01 ppm (Sutrisno and Suciastuti, 1987), but the standard for European countries is 0.05 ppm (Anderson, et al. 1996). Thus the content of cadmium in water according to the Indonesian Ministry of Health and WHO already classified as polluted because it is at a value is 0.01 ppm, but it has not been polluted according to standards for European countries. Whereas according to Effendi (2003), to protect the life of aquatic ecosystems, waters should have a cadmium concentration is 0,0002 ppm.

4.1.3. Cadmium of Sediment

Data for cadmium content in sediments in the five observation stations showed a number <0.10 mg/kg which can be indicated that the sediment in the study site has not been contaminated with cadmium at dangerous limits.

4.2. Lead

4.2.1. Lead of Fish

The lead content of fish in the research location can be seen in Figure 3. In Figure 3 shows that the highest lead content of fish at station 5 is the location around the Port of Paotere is 0.10535 mg/kg, following station 4, the location around the Tallo River Estuary is 0.09305 and the lowest at station 1, the location near the rice plant is 0.0753 mg/kg. This shows that the accumulation of lead metal in fish is inversely proportional to cadmium metal, where the closer to the port, the higher the lead content in fish, vice versa.

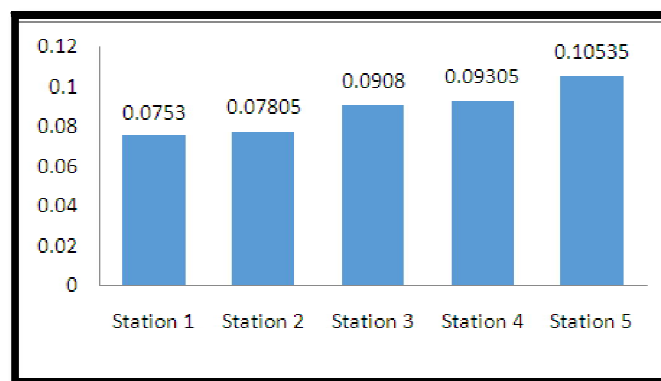


Figure 3: Fish of Lead Content at the Research Site

4.2.2. Lead of Water

Based on Figure 4, it can be seen that the lead content of water in all stations, only station 5 found lead metal in water, namely the location around the Makassar Paotere Port is 0.0091 ppm, while other stations do not find lead metal on water. The high lead content at station 5 is because at that location it is close to people's ports, fish landings and various industries.

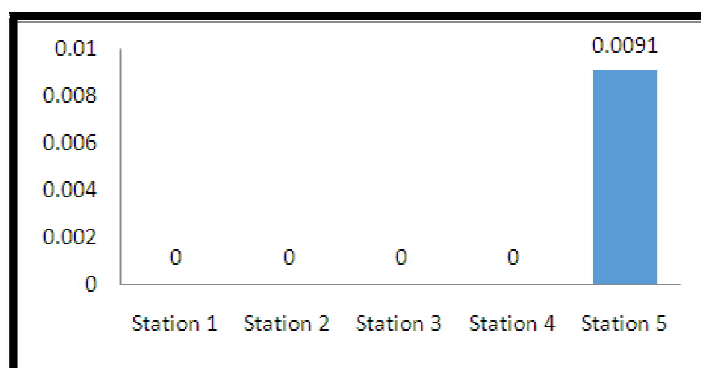


Figure 4: Lead of Water Content at the Research Site

According to State Decree of the Environment of Indonesia No. 51 of 2004 maximum lead content at maximum sea water quality standard is 0.05 ppm. Thus all research locations are not yet at the dangerous lead threshold because they are still below 0.05 ppm.

4.2.3. Lead of Sediment

In Figure 5 shows that the lead content in the sediment is highest at station 5 is 43.3767 mg/kg, following station 3 which is the location around the Tallo Bridge is 37.66255 mg/kg, and the lowest is at station 2 which is the location near

the residential area is 18.0914 mg/kg. Thus it can be said that the lead content in the research site has accumulated into the sediment which directly or indirectly has an effect on lead accumulation in fish.

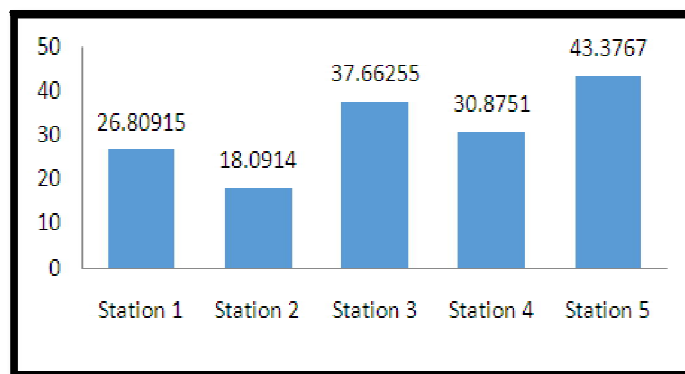


Figure 5: Content of Sediment Lead at the Research site

4.3. Water Quality

4.3.1. Ph of Water

In Figure 6 shows that the average value of water pH during the research is highest at station 5 which is the location around the Port of Paotere is 7.1, following station 4 which is a location around the Tallo River estuary is 7.0, and the lowest average pH value occurs at station 3 which is the location around the Tallo Bridge at 6.5.

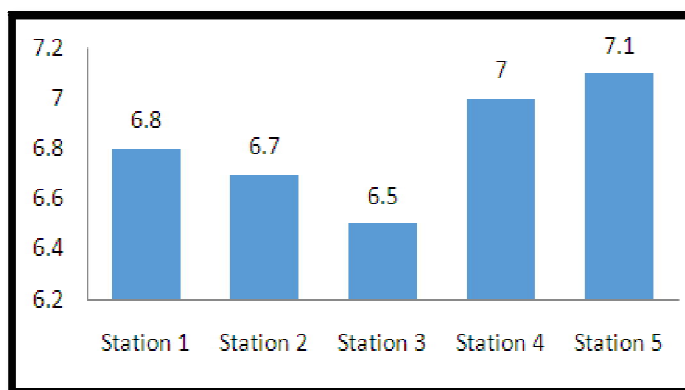


Figure 6: Value of Average Ph of Water during Research

The high pH value at stations 4 and 5 is thought to be due to the high photosynthetic process at that location because it is inhabited by freshwater and saltwater plankton. According to Palar (2004), the increase in pH changes the stability of the form of carbonate to hydroxide which forms bonds with particles in the water, so that it will settle to form mud.

4.3.2. Dissolved Oxygen

In Figure 7 shows that the average value of dissolved oxygen at each station in the research location is highest at station 2 that is, the location around the population settlement is 5.06 ppm, following station 3 which is the location around the Tallo Bridge is 4.92 ppm, and the lowest at station 5 which is the location around the Port of Paotere is 3.72 ppm.

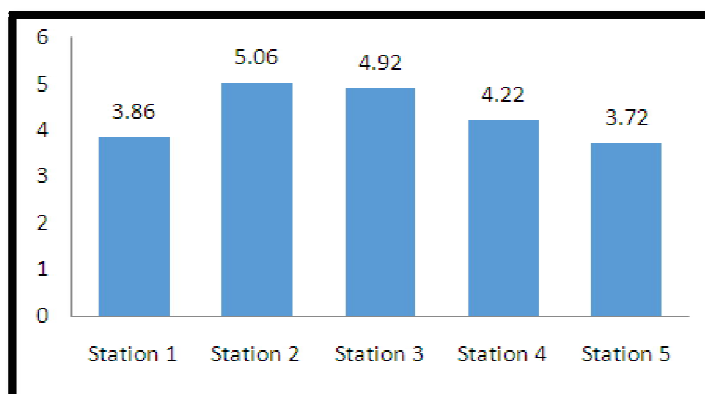


Figure 7: Average Value of Dissolved Oxygen during Research

The low dissolved oxygen at station 5 is thought to be caused by the many organisms that consume oxygen that exist in that location. In addition, the high oxygen content at stations 2 and 3 is thought to be caused by the movement of sufficiently fast water at this location.

4.3.3. Water of Temperature

In Figure 8 shows that the highest average temperature at the research location is highest at stations 4 and 5 respectively at 30.2°C while the lowest temperature is at station 2 which is a location near the residential area.

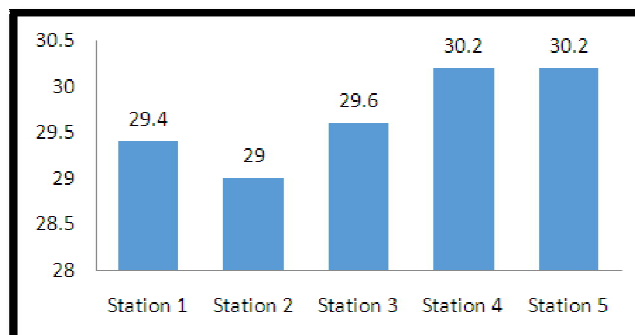


Figure 8: Value of Average Water Temperature during Research

The low average temperature at station 2 is suspected because at that location overgrown with nipa plants so that the temperature of the surrounding waters also low. However, the average water temperature at all stations is still suitable for the life of aquatic organisms. While the high temperatures at stations 4 and 5 are thought to be caused because the location is close to the sea so there is no shade around it.

5. Conclusion

The heavy metal content of cadmium fish at the study site showed cadmium in the highest fish at the research location at station 1 which is the location near the rice plant is 0.0244 mg/kg, the highest cadmium content in water at station 5 which is the location around the Makassar Paotere port is 0.01915 ppm. The water cadmium concentration is dangerous according to the Indonesian Ministry of Health and WHO is 0,01 ppm, but according to standards for European countries it has not been polluted because it is still below 0.05 ppm. Furthermore, the cadmium content in sediments in the five stations showed <0.10 mg/kg which can be indicated that the sediment in the study site has not been contaminated with cadmium at dangerous limits. The highest content of fish lead at the research location at station 5 is 0.10535 mg/kg. While the highest levels of lead water and sediment were obtained at station 5, which were 0.0091 ppm and 43.3767 mg/kg. For water quality shows the average value of water pH during the highest research at station 5 is 7.1. The value of dissolved oxygen is only station 2 with an average value above 5 ppm while the other stations have an oxygen value below 5 ppm. Furthermore, the water temperature at all observation stations is still within the desired range of aquatic organisms

6. References

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