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# THE USE AS BIO-INDICATORS SPONGE *Callispongia sp*. HEAVY METALS CD METAL CONTAMINATION IN THE WATERS OF THE AMBON BAY

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**ABSTRACT**

The deposition of heavy metals in Ambon Bay was investigated by using sponge species (*Callispongia sp.*) as bioindicator. Two different sampling schemes are discussed in this paper: a random sampling scheme with 8 sampling sites distributed over the whole territory of Ambon Bay. Unwashed, dried samples were totally the concentrations of metal elements were determined by inductively coupled plasma atomic emission spectroscopy (ICP-AES). Heavy metal Cd. The median concentrations and statistical parameters of elements were discussed by comparing two sampling schemes. The results of both sampling schemes are compared with the results of other the location of the net. Different levels of the contamination valuated by the respective contamination factor (CF) of each element are obtained for both sampling schemes, while the local contamination identified like cadmium metallurgy and cement industry, oil refinery, mining industry, and transport have been the same for both sampling schemes. In addition, the natural sources, from the accumulation of these metals in sponge caused by metal-enriched soil, associated with activity in the land were pointed as another possibility of local factors.

**Keywords:** Ambon Bay; Heavy metal Cd; Sponge *Callispongia sp.*

## 1. INTRODUCTION

Metals are naturally, has a low concentration in water (Hutagalung, 1991). High and low concentrations of metallic elements, caused by a number of insert metal waste into the waters. In this case influenced by the spread of settlements, especially those located in coastal areas. With a wide range of human activities on land, sooner or later will be able to donate a metal concentrations in water. The metals get into the water system will

be removed from the water bodies through three processes, namely, precipitation, adsorption, and absorption by aquatic biota (Levy et al., 1992). Metal deposition occurs because of the carbonate anions, hydroxyl and chloride (Hatagalung, 1984).

The metals are dissolved in water at a certain concentration would be toxic to the aquatic biota. Metal cadmium (Cd) is one of the important metal and many of its usefulness. Metal cadmium is generally used for electroplating, batteries, phosphate fertilizers, fungicides, plastics industry, and as paint colorants (Campbell, 2006). In addition to the low concentrations used by the industry in the processing of bread, fish processing, beverage processing, and textile industries (Revelation, et al., 2008). In connection with the diverse use of cadmium metal will cause the feared will have an impact on the waters.

Therefore the purpose of this study was to determine the concentration of Cd metals in water, sediment and *Callispongia sp.* sponge and metal concentration distribution at eight locations in Ambon Bay so that we can anticipate the possible negative impacts on the environment in the coastal waters of Ambon Bay.

## 2. MATERIAL AND METHODS

Research materials are: sponges from in Ambon bay; Acetone (Merck), $HNO_3$ (p.a), double distilled water and Whatman filter paper. Sponge samples were collected by diving, cleaned and then placed in a plastic bag and put in the ice box. 0.5 grams of sample was put in beaker glass, add 5 mL $HNO_3$ and then heated at 150 $^0$C for 2 hours. After being cooled at room temperature, sample put in 25 mL volumetric flask, match the volume with double distilled water and filtered with Whatman paper and solution is ready to be analyzed by ICP-OES Perkin Elmer 3000. One liter of water sample was taken at the bottom, and immediately filtered with filter paper of cellulose nitrate (0.45 μ) after previously washed with 1N $HNO_3$ and then preserved in $HNO_3$ 5%. 250 ml water sample is inserted in a Teflon separating funnel, then extracted with APDC-NaDDC/MIBK. The organic phase was extracted again with 5% $HNO_3$ solution, filtered back, and ready for analysis by ICP-OES Perkin Elmer 3000. For sediments, they were taken from the bottom with a Van Veen Grab sampler, stored in polyethylene bottles and taken in laboratory put in a Teflon beaker and dried in an oven at a temperature of 105 $^o$C and after drying, rinsed

3 times with double distilled water then dried again. A total of 5 g sample was destructed in Teflon beaker with solution of $HNO_3$/HCl (1:3) at 100 °C for 8 hours. After that, the solution was filtered, and the filtrate is ready to be analyzed by ICP-OES Perkin 3000.

## 3. RESULTS AND DISCUSSION

### General Situation of Sampling Locations


**Figure 1.** Location of Sponge Sample at Ambon Bay.

### Heavy Metal Cd in the *Callispongia sp.*

The measurement results Cd metal concentrations in water, sediments and sponge *Callispongia sp.* in Ambon Bay waters are presented in Table 1.

**Table 1.** Concentration of cadmium (Cd) in water, sediment and Calispongaia sp.

| Location | Total Skeleton + Tissue | Skeleton | Tissue | Water | Sediment |
|---|---|---|---|---|---|
| Halong | 0.014 | 0.009 | 0.005 | 0.004 | 0.009 |
| Kota jawa | 0.012 | 0.002 | 0.010 | 0.001 | 0.019 |
| Hative | 0.004 | 0.002 | 0.002 | 0.008 | 0.013 |
| Amahusu | 0.012 | 0.003 | 0.009 | 0.003 | 0.006 |
| Batu capeo | 0.015 | 0.003 | 0.012 | 0.005 | 0.007 |
| Ery | 0.036 | 0.019 | 0.017 | 0.004 | 0.050 |
| Latuhalat | 0.410 | 0.002 | 0.408 | 0.008 | 0.020 |
| Pulau tiga | 0.042 | 0.002 | 0.040 | 0.002 | 0.002 |

Data from the analysis of Cd metal concentrations in Table 1 shows the concentration of Cd in the water at all research locations around 0,001 ppm - 0,008 ppm,

with the highest concentration in Latuhalat (0.04 ppm) and Batucapeo (0.03 ppm). Research data is compared with the normal Cd concentration in sea water which is 0.11 ppb or 0,0011ppm (Murphy, 1978 in Lestary et 2004), the metal concentrations of Cd in Ambon Bay waters have suffered heavy metal pollution Cd.

While Cd metal concentrations in sediment ranged from 0.002 to 0.050 ppm in locations where the highest ery of 0,030 ppm, and the results obtained were compared with the standard SEPA (the Swedish Environment Protection Agent) in Table 2. Classified into classes that are not significant in aquatic environments

**Table 2.** The Basic Standard Cd Metal Concentrations in Sediments According to SEPA

| Heavy Metal | Class 1 Not significant | Class 2 lightweight | Class 3 Significant | Class 4 weight | Class 5 very large |
|---|---|---|---|---|---|
| Cd | <0.2 | 0.2-0.5 | 0.5-1.2 | 1.2-3 | >3 |

This is in line with the statement Forstner and Whittman (1983), that Cd in aquatic sediments predominantly in the form of CdCO3, as well as research conducted by Liu, et al (2011) showed that Cd in the waters high due to Cd form a molecular complex with Chloride ( cd-Cl). This is supported by the statement of Carol, et al (2002), which states that the Cd in marine waters form a complex with 99% hydrochloric

Cd is one of the heavy metals that are toxic and harmful to all organisms, but also dangerous for humans. In the water body, the solubility of Cd in certain concentrations can kill aquatic biota. Biota that are categorized nation crustaceans (crustaceans) will experience death in an interval of 24-50 hours if in a water body where these organisms live Cd dissolved metals or compounds in the concentration range between 0.005-0.15 ppm. Sharma, et al., 2010 explained that most of the heavy metals that enter the aquatic environment will accumulate in the sediments and can move into other environmental matrices, this is in line with the opinions Gbraouko et al, 2007; Sobolovet et al., 2008 that the marine environment is generally heavy metals accumulate in sediment and biota. Amin et al., 2005 explained that 90% of heavy metal contaminated waters will be deposited in the sediment.

The results of the analysis formed two groups on two main axes are able to explain 73.7% of the variation that occurs (Figure 2). Group 1 is represented by the location

Amahusu, Latuhalat, Ery and three islands which are characterized by the influence of currents and resulting pH Cd metal bioaccumulation more dominant by the water and sediment, and at this location and the current influence of pH by 55% from 73.7%, which according to Palar (2008) behavior of metals in the environment is very dynamic and affected by physical-chemical conditions of pH, temperature and salinity. Group 2 is the location. City of Java, Batu Capeo, Hative, and Halong bioaccumulation of metals Cd 18.7% influenced by temperature and salinity.

The linkage with the metal sponge sp Callispongia Cd analyzed by PCA (Figure 2).

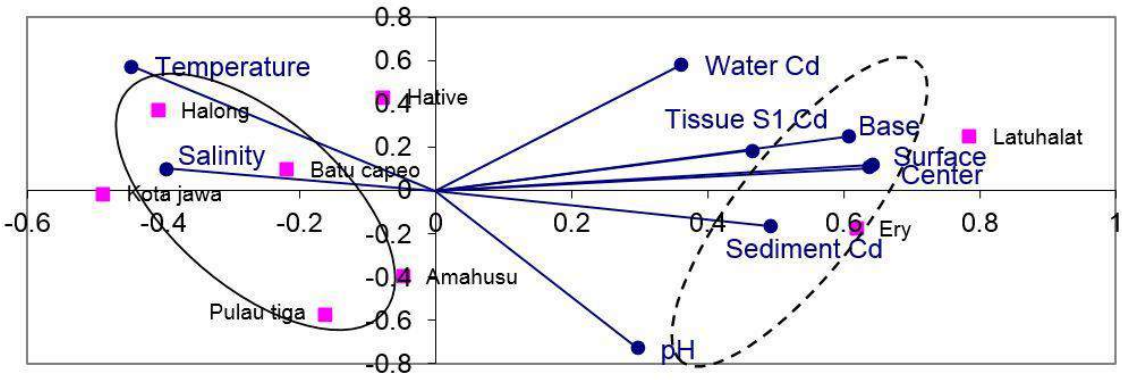


**Figure 2.** Linkage Cd Metal in *Callispongia sp.* with Physical-Chemical Parameters of Environment Research Sites.

This is in line also with the research conducted by Celestial et al. (2010) which states that the sponge *Callispongia sp.* more suitable for the analysis of heavy metals Cd and it proved to all is the dominant location for Halong waters, it is, according to research conducted by Perez, 2001 that the species or species of sponges that determines the accumulation of metal concentration.

## 4. CONCLUSION

From the research data on the results and discussion, the authors draw the following conclusion: There are significant differences between the location where the locations that have the highest activity then by its own concentration of Cd will be higher than with a location that does not have the activity, so that the entry of metal Cd which bioaccumulate in the sponge comes from anthropogenic.

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