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Research Paper

Distribution Of Cadmium (Cd) Within Water Around The Final Waste Disposal (FWD) Of Sukawinatan Palembang

Deni Julius[1]*, Suheryanto[2], Laila Hanum[3],

[1] *Department of Environmental Management, School of Graduate Program, Sriwijaya University, Jalan Padang Selasa, Palembang, Indonesia*
[2] *Department of Chemistry, Faculty of Mathematics and Science, Sriwijaya University, Jalan Palembang Prabumulih Km 32, Indralaya, Indonesia*
[3] *Department of Biology, Faculty of Mathematics and Science, Sriwijaya University, Jalan Palembang Prabumulih Km 32, Indralaya, Indonesia*
***Corresponding author e-mail**: accountname@email.com

Abstract
Research has been conducted on the Bioacumulation of Cadmium in the Leachate, Sediment, Sepat fish and watercress within water around the final waste disposal (FWD) of Sukawinatan Palembang used Atomic Absorption Spectrophotometric (AAS) analysis.This research determined the distribution of cadmium that was contained in water ecosystem within water around the final solid waste disposal (FWD) of Sukawinatan, as well as bioconcentration factor (BCF) of the biotic compartement to the abiotic compartement. The way was done by wetdestruction sample. The resultant destruction solution was analyzed at a wavelength of 228.8 nm. The results showed that the concentration of cadmium in leachate Inlet 0.0099 mg/L until the Sedapat River 0.0010 mg/L, Sediment Inlet 0.0427 mg/Kg until Sedapat River Sediment 0.0051 mg/Kg, Sepat fish reservoir 0.0099 mg/Kg and Sepat fish Sedapat River 0.0096 mg/Kg along watercress reservoir 0.0042 mg/Kg is over Sedapar river 0.0027 mg/Kg. So, the distribution of cadmium for water and sediment compartment decreased from leachate inlet to Sedapat river. The value of cadmium consentration in leachate is still below the threshold conformable in regulation of environment and forestry ministers no.59 of 2016 is 0.1 mg/L. Distribution on the fish and watercress compartment also descreased to the Sedapat river. Consentration value on the fish and watercress also still below the quality standard in this SNI 7378;2009 for fish 0.1 mg/Kg and watercress 0.2 mg/Kg, while the value of BCF fish and BCF watercress ¡100 is still in low category.

Keywords
Distribution, Cadmium, Bioconsentration factor

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1. INTRODUCTION

One landfill in the city of Palembang is located on an area Sukawinatan Sukajaya Sukarame subdistrict in Palembang, South Sumatra. Every day, the amount of waste that goes to landfill Sukawinatan are ± 500-600 tonnes/day. Waste composition that goes into landfill Sukawinatan are food scraps, leaves and paper which is an organic material. Then the solid waste and B3 which potentially contain cadmium contamination i.e. batteries, thermometers, fluorescent lights, steroform are not managed properly. According to Warsinah (2015), Pb heavy metal levels around the landfill leachate Sukawinatan as below 0.09 mg/L, the river far as 0.025 mg/L, sediment 9.10 mg/Kg, Plant 1,43 mg/kg and fish 0, 94 mg/Kg.

Based on these data, the decomposition of waste going into landfill affects the amount and type of contamination. Garbage decomposition process produces two major factions, namely organic and inorganic fractions. The inorganic fraction contains a variety of minerals, including heavy metals.

Heavy metals was contained in the garbage decomposes and dissolves along with the formation of leachate. All results of this decomposition to form a unity with the ground. The role of land to the transport and removal of contaminants is very large. The transport process is diverse, such as the drainage, seepage, and melting. Heavy metal migration more quickly when the environment around the landfill is an area of water (Palar, 2008).

2. EXPERIMENTAL SECTION

2.1 Analysis of the Metal Content of Cadmium (Cd) in Water Samples

Dilute the samples of leachate with water adjus the pH with HNO_3 to pH¡2 taken as many as 100 mL homogenized by means of a knot, add back in 5 mL of HNO_3, then heat the test sample until almost dried up, demineralized water was added back as much as 50 mL, then pour into the 100 mL volumetric flask using filter

paper, dilute up to 100 mL with demineralized water, after that the samples are ready to be tested.

2.2 Analysis of Metal Content Cadmium (Cd) in Sediments, Watercress and Sepat Fish

Sediment sample is cleaned of impurities, then drain and puree samples. Likewise with Watercress clean and cuts. Sepat fish is measured in length and meat. Each sample was dried in the oven for 24 hours at 60°C, and then mashed it. Fine samples were drawn 2 grams and then inserted into a pumpkin, add a mixture of HNO_3 and HCl in the ratio (3:1) 10 mL hereinafter destruction to dissolve the sample, and then the flask removed from the heater and added H_2O_2 as much as 1 drop and chill. After a solution was cold, it was filtered with filter paper, andit was diluted to 50 mL with demineralized water and Analysis with AAS.

2.3 Data Analysis

Data analysis includes an analysis of the concentration of cadmium metal in the compartment of water, sediment, plants and fish based measurement using AAS instruments. The next stage of analyzing the data descriptively compare measurement data with quality standards in accordance with regulation of environment and forestry ministers no.59 of 2016 about garbage leachate water quality standards, and SNI 7387; 2009 the maximum limit of heavy metal contamination in food.

2.4 Analysis Bioconcentration Factor (BCF)

Watercress and Sepatfish samples calculated value of Bioconcentration factor (BCF), Bioconcentration factor is a parameter used to evaluate the potential of the species in the accumulating compound that is generally used for heavy metals.

Bioconcentration factors for biota (fish) consists of the biota and water BCF (BCFo-w), whereas for the plant consists of BCF plant to water (BCFo-w) and BCF plants against sediment (BCFo-s). Bioaccumulation factor describes the level of metal content in the samples. Bioconcentration factor formula:

$$BCF(o-w) = \frac{Corg}{Cwater} \quad (1)$$

$$BCF(o-s) = \frac{Corg}{Csed} \quad (2)$$

Note:
BCF = Bioconcentration Factor
C org = Cd concentration in organisms
C water = concentration of Cd in water
C sed = concentration of Cd in sediment

3. RESULTS AND DISCUSSION

3.1 Cadmium Concentration on Compartment Water and Sediments

Concentrations of cadmium found in the water compartment was analyzed in some sampling area, covers an area Inlet, Leachate pool, Processing Pool, Outlet and Sedapat River show in the Table 1. Cadmium concentration research results showed a downward trend, both compartments of water and sediment. The highest concentration value at an Leachate inlet 0.0099 mg/L and the lowest at River 0.0010 mg/L. The value of cadmium consentration in leachate is still below the threshold conformable inregulation of environment and forestry ministers no.59 of 2016 is 0.1 mg/L.

The concentration of dissolved cadmium can be influenced by the distance from the source of leachate. Closer distance to the source of leachate will have a greater Cd levels than longer distances. The cause of this situation is the concentration of leachate is more concentrated than at large distances. So the more concentrated the leachate consentration, the level of metal Cd concentration automatically is also large.

Likewise with cadmium concentrations of sediment showed a trend of decreasing when the distance is further away from the sources of pollution. The concentration of cadmium contained in the sediments inlet 0.0427 mg/kg and the smallest on the river far as 0.0051 mg/Kg.

3.2 Cadmium Concentration in Watercress (*Ipomoea Aqutica*) and Sepat Fish (*Trichogaster trichopterus Pallas*)

The concentration of cadmium metal in Water Kangkuang was listed in Table 2. The Cd accumulates in the pool 4 was 0.0042

Table 1. The Concentration Of Cadmium In Abiotic Compartment

Location	Concentration of Cadmium in Abiotic Compartment			
	Water (mg/L)	Water Quality Standard (mg/L)	Sediment (mg/Kg)	Sediment Quality Standart (mg/Kg)
1. Inlet	0.0099	0.1	0.0427	ANZECC
2. Leachate Pool	0.0096	0.1	-	ISQG-Low
3. Pool 1	0.0075	0.1	0.0314	-1.5
4. Pool 2	0.007	0.1	0.0306	
5. Pool 3	0.0069	0.1	0.0222	
6. Pool 4	0.0038	0.1	0.0143	SEPA year of 2000
7. Outlet	0.0035	0.1	0.0075	($\leq$ 0.8 -Kelas 1-very low conc.)
8. Sedapat River	0.001	0.1	0.0051	

*Regulation of Environment And Forestry Ministers No.59 Of 2016

Table 2. Concentrations of Cadmium in Biotic Compartment

locations	Concentration of Cadmium in Biotic Compartment (mg/Kg)			
	Sepat Fish	*Quality standards	Watercress	*Quality standards
1. Pool 4	0.0099	0.1	0.0042	0.2
2. SedapatRiver	0.0096	0.1	0.0027	0.2

*SNI 7378;2009

mg/Kg whereas in rivers far as 0.0027 mg/Kg. This value is still below the threshold contained in SNI 7383; 2009 of 0.2 mg/Kg. One factor, that accumulation of heavy metals in aquatic organisms such as watercress,was temperature.

In the marine environment, the chemical reaction is very sensitive to temperature changes, besides the temperature also greatly affects the quantity of heavy metals are absorbed by plants. Rising temperatures affect intake and expenditure levels of heavy metals by plants because of rising temperatures increase the rate of metabolism in aquatic plants (Manahan, 2000).

The concentration of cadmium in the flesh of Sepat fish in the pond was 0.0099 mg/Kg and rivers far as 0.0096 mg/Kg. According to SNI 7378; 2009 The concentration of cadmium in fish value is still below the quality standard is 0.1 mg/Kg.

Under natural exposure conditions, prediction of toxic effects based on environmental or tissues concentrations remains difficult while many studies have examined the relationship between metal exposure, accumulation and toxicity under laboratory conditions (Ali et al., 2013).

3.3 Bioconcentration Factor (BCF) Watercress and Sepat Fish

From the calculations, the bioconcentration fish ponds and the river far as 7.7000 1.2392. As for the pool water to water spinach (BCFo-w) on an 0.0438 and 2.7000 river, the plant against sediment Bioconcentration factor (BCFo-s) 0.1892 and 0.5294 on river. Bioconcentration factor is higher than the fish with watercress caused by the high mobility of fish in the water, so the fish bioconcentration against higher water. While water is just creeping watercress in pool, so the interaction watercress limited only around the edge of the pond or river. Likewise watercress to sediment only interaction around the edge of the pond and river. So that the accumulation is increased through gills that interact with water and digestive organs untilfish tissue.

According to Van Esch (Amriani and Hadiyarto, 2011), when the value of BCF less than 100 in the category of low accumulative value 100-1000 categories accumulative moderate and above 1000 high accumulative. Overall bioconcentration factor fish and watercress to water in ponds and rivers as much as ¡100 classified as low accumulative.

3.4 Distribution Metal Cadmium In Different Compartments

Cadmium distribution of inlet flow pattern, the leachate pond, settling ponds uotle up towards the river Wherever the water and sediment compartment tends to decrease, as well as in plants and organisms tends to decrease as seen in Figure 1. The highest distribution on the sediment compartment, the high metal concentrations in sediment deposition resulting from the effects of the chemical, oxidation-reduction events and acidity, adsorption phenomena of physics effects and biological effects characterized by bacterial activity.

Metal distribution in each compartment based on the distance from the inlet to the pond to the extent to compartments river water and sediment, the concentration of cadmium decreased. For plants and fish in the river, metal concentrations are lower than the concentration of metal in the settling ponds. The presence of cadmium in plants and fish indicate the accumulation in the compartment.

In particular, bioaccumulation of Cd, Arsenic, Manganese,

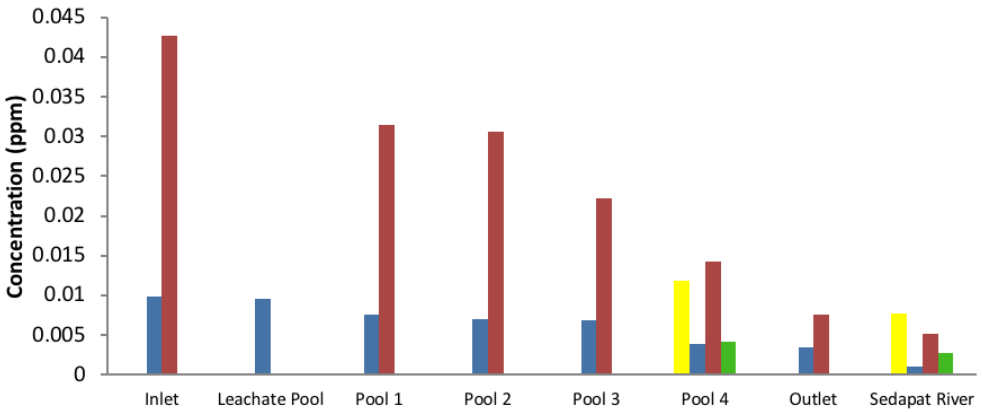

Figure 1. Graph Distribution Of Cadmium In All Of Compartments

Mercury, and Lead in the food chain is a cause of concern because these metals have deleterious effects on human health Furthermore, fish and seafood is one of the main links between heavy metal present in the environment and human exposure (Fraser et al., 2012).

4. CONCLUSIONS

Levels of cadmium in water is still below the environmental quality standard set out in the Regulation of the Minister of Environment and Forests no. 59 of 2016. Bioconcentration factor of fish to water (BCFo-w) in the pool and the river, as well as bioconcentration watercress for metals in water (BCFo-w) and sediment (BCF0-s) in the pond and the river Wherever ¡100 classified as low accumulative. Distribution of cadmium metal for water and sediment compartment increasingly distant sources of leachate is up to the river Inlet concentration decreases. In fish and watercress metal distribution in the settling ponds is higher than Wherever River.

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