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Eucheuma Denticulatom as Potential Biosorbent for Lead Nitrate, Cadmium Sulfide and Zinc Sulfate Contaminated Waters

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Abstract. This study was conducted in order for the proponent to determine if Eucheuma Denticulatom could absorb heavy toxic metals on water such as Lead Nitrate, Cadmium Sulfide and Zinc Sulfate. On the 30th day of observation, the color of all the replications for Lead, Cadmium and Zinc changed which signifies that there was clearly an effect. On the very same day, the titration test was conducted with the use of Potassium permanganate in order to test if there were metal residues left on water. After thorough and series of tests it was then proven that Eucheuma Denticulatom removed metal ions of lead nitrate, cadmium sulfide and zinc sulfate in water, it is also proven that Treatment 5 is the most comparable treatment with treatment 1 or the positive control. Results show that Eucheuma Denticulatom is an interesting source of phytoremediation material in treating contaminated waters.

Keywords: Eucheuma Denticulatom, Heavy metals, Phytoremediation, Titration

1. Introduction

1.1. Background of the Study

Fresh water quality and availability remain one of the most critical environmental and sustainability issues of the twenty first century (Adebo and Adetonyinbo, 2009)[1]. Water will continue to be a major issue with definite and profound importance on our live and that of the planet earth. The availability of safe and reliable source of water is an essential pre-requisite for sustainable development.

However, with the ever increasing scientific and industrial developments, man is continually exposed to some health hazards from heavy metal through water intake among other sources. Heavy metals are presently in the soil, natural water and air, in various forms and may become contaminant in food and drinking water. Some of them are constituent of pesticide, paints, fertilizers etc. The concentration of these metals needs to be reduced to meet the ever changing legislative standards. Wuyep et al. (2007) [10] reported that the metals of most immediate concern are cadmium, cobalt, lead, nickel, mercury and zinc. The presence of such metals (>5 $mgcm^{-3}$) (Wuyep et al., 2007) [10] in aquatic environment, causes severe damage to aquatic life, killing microorganisms during biological water purification process. Moreover, these metals have exacting consequences on human such as brain damage, reproductive failures, nervous system failures, tumor formation etc (Wuyep et al., 2007) [10].

Conventional processes for removal of metals from industrial waste include chemical precipitation, oxidationreduction, filtration, electrochemical technique and other sophisticated separation procedure using membranes. These processes are expensive and time consuming and have inherent limitations (Akporhonor and Egwaikhide, 2007; Adebo and Adetonyinbo, 2009; Osemeahon et al., 2007) [3]. The need for economical and effective method of removing heavy metals from waste water has resulted in the search for unconventional materials that may be useful in reducing the levels of accumulation of heavy metals in the environment. Biological methods such as bio-sorption or bio-accumulation strategies for the removal of

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metal ions may provide an attractive alternative to existing technologies (Akporhonor and Egwaikhide, 2007)[3].

1.2. Objectives of the Study

This study aims to investigate The Bioremediation Potential of *Eucheuma Denticulatum* against Heavy Metals using a quantitative approach. Specifically, this study was conducted to answer these questions:

- Is *Eucheuma Denticulatum* effective in absorbing lead, cadmium and zinc in water?
- Is there a significant difference on the effectiveness of *Eucheuma Denticulatum* on the positive and negative controls?
- What is the best treatment in removing heavy metals on water?

1.3. Significance of the Study

Phytoremediation takes advantage of plants' nutrient utilization processes to take in water and nutrients through roots, transpire water through leaves, and act as a transformation system to metabolize organic compounds, such as oil and pesticides. Or they may absorb and bioaccumulate toxic trace elements including the heavy metals, lead, cadmium, and selenium. In some cases, plants contain 1,000 times more metal than the soil in which they grow. Heavy metals are closely related to the elements plants use for growth.

The cost of the phytoremediation is lower than that of traditional processes both *in situ* and *ex situ*. The plants can be easily monitored. The possibility of the recovery and re-use of valuable metals (by companies specializing in "phyto mining"). It is potentially the least harmful method because it uses naturally occurring organisms and preserves the environment in a more natural state.

1.4. Scope and Limitations

This study was conducted at the Sultan Kudarat Provincial Soils and Water Laboratory Bo. 2, Tacurong City. This is only limited to the Bioremedial effects of *Eucheuma Denticulatum* on lead, cadmium and zinc, and no other plants or contaminants were used in this experiment.

This study employed 5 treatments and 3 replications. Titration Testing was conducted to determine the amount of lead, cadmium and zinc that was absorbed by the weed.

The said experiments were conducted from February 2011 to February 2012 at the Sultan Kudarat Provincial Soils and Water Laboratory.

1.5. Hypotheses

ALTERNATIVE:

Eucheuma Denticulatum can effectively lower the amount of lead, cadmium and zinc in water.

NULL:

Eucheuma Denticulatum can't effectively lower the amount of lead, cadmium and zinc in water.

2. Methodology

2.1. Research Design

This study follows a simple experimental research design. It attempts to improve our water supply by using sea weeds to get rid of lead, cadmium and zinc.

This study will include one (1) test which was conducted in the Sultan Kudarat Provincial Soils and Water Laboratory. It is said to find out the effect of sea weeds in lowering the lead, cadmium and zinc content in water. 2000 ppm of lead was dissolved in 500 ml water in 6 containers with triplicates in 5 treatments, treatment 1 as the positive control with 15g commercial carbon, treatment 2 as the negative control with 500 ml water, treatment 3 with 15g seaweed, treatment 4 with 30g seaweed and treatment 5 with 45g seaweed. The same procedure was done on zinc and cadmium. The experimentation lasted for 30 days.

Data gathered will be analyzed based on experimentation, done after the 30^{th} day of observation, by means of titration using appropriate reagents.

2.2. Procedure

2.2.1. Collection of Specimen and Materials used

Eucheuma Denticulatom in the experiment was bought from General Santos City Aquatic Laboratory. The experiment started after it was gathered.

The chemical used such as Lead Nitrate were all obtained from the Chemical Laboratory of Notre Dame of Marbel University. Other laboratory materials such as surgical gloves, alcohol, etc, were all bought from pharmacies in the locality. Laboratory gowns were provided by the proponent.

The laboratory glass wares and necessary laboratory equipments used in the study were obtained from the Provincial Soils and Water Laboratory, where the experimentation transpired.

2.2.2. Weighing of *Eucheuma Denticulatom* and metals used

An analytical balance was used to weigh different treatments of *Eucheuma Denticulatom* (15, 30 and 45 grams). An analytical balance was used to weigh 2000 ppm of Lead. A graduated Cylinder was used to measure 500 mL of distilled water and poured to the 6 water containers. The same procedure was done for cadmium sulfide and zinc sulfate. Different containers for different treatments and replications were labeled properly.

2.2.3. Applying Sea Weeds to the Contaminated Water and Non-Contaminated Water

After preparing the contaminated water and *Eucheuma Denticulatom*, 15, 20 and 45 grams of *Eucheuma Denticulatom* was transferred to each of the containers and was stirred with a stirring rod to evenly distribute the *Eucheuma Denticulatom*. The mixture was then observed for color change for 30 days.

2.2.4. Titration Test

On the 30^{th} day, water was removed from all of the containers and transferred to different water containers. 100 mL of the water from each container will be used for the Titration Test. The water was transferred to an Erlenmeyer flask under a titration tube with Potassium permanganate. To test this, we must add Potassium permanganate to the water until its color becomes pink then record the number of mL of Potassium permanganate used for the replication. Repeat the process with clean flasks for all of the replications for lead, cadmium and zinc.

3. Results and Discussions

This chapter presents the data analyzed by the proponents from the samples prepared from the Sultan Kudarat Provincial Soils and Water Laboratory.

Values in the same- not sharing a common superscript to the control (A) and (B) differ significantly ($P<0.05$)

The table above showed the amount of Potassium permanganate used for the treated Lead, Cadmium and Zinc contaminated waters also with the positive and negative controls.

Result shows that the higher the concentration the better phytoremediation will be. This is shown and proved by the results above using different levels of *Eucheuma Denticulatom* having 45g *Eucheuma Denticulatom* as the most effective of three treatments and 15g *Eucheuma Denticulatom* as the least effective.

4. Conclusions

Based on the experimentation performed, results and information drawn together, the researcher was able to formulate the following conclusions:

- *Eucheuma Denticulatom* was proven to remove lead, cadmium and zinc in water.
- There is no significant difference on the effectiveness of *Eucheuma Denticulatum* and Positive control or commercial carbon.
- Treatment 5 is the most comparable treatment with treatment 1 or the positive control and the most effective of all treatments.

Table 1: Mean Amount of Potassium permanganate used for treated Lead, Cadmium and Zinc Contaminated water

Treatments	Lead Nitrate	Cadmium Sulfide	Zinc Sulfate
15g commercial carbon	0.19 mL[a]	0.27 mL[a]	0.24 mL[a]
Distilled water	1.52 mL[b]	1.65 mL[b]	1.43 mL[b]
15g *Eucheuma Denticulatum*	0.41 mL[c]	0.52 mL[c]	0.52 mL[c]
30g *Eucheuma Denticulatum*	0.40 mL[c]	0.35 mL[a]	0.31 mL[a]
45g *Eucheuma Denticulatum*	0.21 mL[a]	0.30 mL[a]	0.26 mL[a]

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