Effect Addition Of Coconut Fiberon Effectiveness Chromium(Cr)Phytoremediation In Tannery Solid Waste Using Alocasiamacrorrhiza

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ABSTRACT: Leather industry is using chromium for tanning process. Solid waste from this process directly are dumped to land. This waste is hazaroudus to enviromentThe aims of this study is toinvestigate addition of coconut fiber on solid tannery waste to effectiveness chromium phytoremediation using *Alocasiamacrorrhiza*. Coconut fiber used is 75 g (A1), and 150 g (A2), while biomass of *Alocasiamacrorrhiza* used is 200 g (B1), and 400 g (B2). This study was conducted for 15 days. Parameters measured are total chromiumin solid waste, total chromium in fiber coconut,total chromium in plant, total chlorophyll, and plants.biomass. Result showed, the addition of coconut fiber in the tannery solid waste does not affect the effectiveness of chromium phytoremediation. However, the plants treated with the addition of fiber coconut can survive longer than the plants without addition of coconut fiber (control). The largest effectiveness in total chromium which occur in the control is 40.36%.
KEYWORDS : Tannery waste, chromium, Phytoremediation, *Alocasiamacrorrhiza*, coconut fiber

1. INTRODUCTION

Leather industry is using chromium for tanning process. Tanning process generated three types of waste in the form liquid waste, solid waste, and gaswaste. The waste generated from various processes that occur in the pre-tanning, tanning and post-tanning. Approximately 60-70% chromium sulphatecan not be absorbed through the skin in the tanning process so that discharged into form of waste. The existence of high concentrations of chromium in solid waste can certainly cause pollution to the environment (Ricardo, 2003). Chromium is a dangerous heavy metals in the environment and can enter to food chain that can causedhigh risk to human health (Palar, 2008).

Chromium is found in nature in two forms of oxides, ie Cr (III) and Cr (VI). Cr (VI) is carcinogenic and mutagenic higher than the Cr (III). The level of toxicity of Cr (III) is only about 1/100 of Cr (VI) (Slamet and Danumulyo, 2003). Chromium can be dangerous if it goes into the metabolic system in an amount that exceeds the threshold. Excess chromium in the human body can cause disorders such as severe anemia, nervous system damage, impaired immune function, nausea, vomiting, kidney damage can occur in the long term (Asmadi et al., 2009).

Alternative technique that is cheap and effective way to overcome the problems of chromium pollution is bioremediation. Bioremediation is a process for recovery of land contaminated by organic wastes or inorganic wastes by utilizing organism. The bioremediation method that uses plants called phytoremediation (Mangkoediharjo, 2005).

Alocasiamacrorrhiza is a plant that has potential as phytoremediator and can accumulate heavy metals. *Alocasiamacrorrhiza* can tolerate the presence of Pb and Cd in soil (Liu et al., 2010). *Alocasiamacrorrhiza*can accumulate high amount of Zn metal.(Ren et al., 2006). To improve absorptioneffectiveness of chromiumwe add coconut fiber as absorbent. Coconut fiber can be used as a medium phytoremediation plants. Coco fiber is potentially as biosorbent because it contains cellulose in their molecular structure containing carboxyl groups and lignin-containing phenolat acid that serves to bind metals (Pino, et. Al, (2005).

The aims of this study is to investigate addition of coconut fiber on solid tannery waste to effectiveness chromium phytoremediation using *Alocasiamacrorrhiza*. The benefits of this research to provide an alternative tannery wastewater treatment that is effective, economical, and environmentally friendly.

2. RESEARCH METHOD

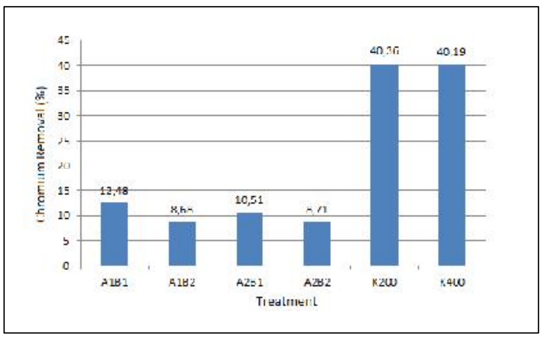
The study was conducted by an experimental method. The measured variable are total chromium in solid waste, total chromium in fiber coconut, total chromium in plant, totalchlorophyll, and plants.biomass.measurement of chlorophyll content using methods spetrofotometer and concentration of chromium by AAS method (Atomic absorbent spectrophotometer) The Treatment showed in Table 1.

Tabel 1. Treatment plant biomass and weight of coconut fiber

Kode	Plant biomass	Weight Coconut Fiber
A1B1	200g	75g
A1B2	400g	75g
A2B1	200g	150g
A2B2	400g	150g
K200	200g	-
K400	400g	-

3. RESULT AND DISCUSSION

Research showed that the initial total chromium in tannery solid waste is 7465 ppm. Thisconcentration is above the waste quality standard. Based on the National Sediment Quality Survey conducted by the United States Environmental Protecting Agency (US-EPA), total chromium values are allowed in industrial sediments is 76 ppm. After being treated for 15 days, Chromium concentration decreased range 8.68% to 40.36%.



removal on solid waste

Total chromium in solid waste significantly different between control with treatment. The highest Effectiveness of total chromium removal is control 200 with effeticvitness 40.36%, This showed that the addition of coconut fiberdoes not affect the increasing efficiency of remediation.it happens because of internal factors that affect the ability to absorb metal such density, particle density and retention of phytoremediation process. (Pinandari et al., 2011).Coconut fiber used in this study is coarse texture (unprocessed). The quantity of coconut fiber does not affect the ability of absorption of chromium as a metal ion binding mechanism by absorbent. Absorption depends on the chemical nature of the metal ion (size and type of ionic charge), types of biomass, the environmental conditions (pH, temperature, ionic strength) and its existence competing with organic materials, inorganic, or other heavy metals (Wilde and Benemann, 1993). This is further supported by the Langmuir isotherm sorption equilibrium formula is only influenced by the pressure and temperature, but it is not influenced by the amount of adsorbent (Kresnawaty, 2007).

Total chromium concentrationin coconut fiberin day 0 and day 15 showed that are not significantly different at each treatment. The highest absorptioneffectiveness of chromium by coconut fibers is A2B1 with absorption effectiveness are 83.51%, while the lowest is A2B2 with absorption effectiveness are 69.08%.

The quantity of coconut fiber does not affect the ability of chromiumabsorption. Absorption depends on the retention time between the coconut fiber as biosorbent with chromium. Coconut fiber can bind metals within a specific time frame, where the adsorption increases with increasing duration of contact (Pinandari et al., 2011).

Tabel 2. Effeciency ofChromium Absorption by coconut fiber

Treatmen	Chromium Total Day-0	Chromium Total Day-15	Absorband Efectivity (%)
A1B1	8,5±0,00	50,19±0,61[a]	83,04
A1B2	8,5±0,00	51,56±0,40[a]	83,51
A2B1	8,5±0,00	37,87±0,13[a]	77,55
A2B2	8,5±0,00	27,49±0,68[a]	69,08

The Efectivitychromium absorption by plants occurs in K400 is 67.30%. Chromium accumulation in plants is lower than Efectivity chromium absorption by coconut fiber.It can caused by chromium that accumulates in many parts of the soil in a form that can be absorbed by plants. Adsorption process conducted by the plants depends on properties of atoms or molecules are absorbed, concentration, temperature, and others.

Tabel 3. Effeciency of Chromium plant accumulation

Treatment	Chromium Total day-0 (ppm/gr)	Chromium total day-15 (ppm/gr)	effectiveness (%)
A1B1	0,685±0,000	0,199±0,006^{a}	65,54
A1B2	0,685±0,000	0,112±0,003^{a}	38,73
A2B1	0,685±0,000	0,150±0,006^{a}	54,42
A2B2	0,685±0,000	0,135±0,004^{a}	49,37
K200	0,685±0,000	0,169±0,000^{a}	59,37
K400	0,685±0,000	0,210±0,000^{a}	67,30

The results of anatomical observations indicate that there are differences in leaf anatomy control on day 0 compared the anatomy of the leaves on the 15th day. K200 and K400 on leaf color is pale because of their chlorophyll produced less due to the stress from the metal chromium. The color change is one of the symptoms of the toxicity of chromium contained in the tannery waste.This is consistent with research Liu et al. (2010) that *Alocasiamacrorrhiza*by stress of heavy metals such as Pb and Cd

Chlorophyll color changes to yellow. In addition, on the leaves of the plant control many parts are damaged, especially on the mesofilnya. There is no real difference between the anatomy of leaves at day 0 and day 15 in all treatments. Although the effectiveness of chromium metal reduction in all treatments is lower than in the controls, but with the addition of coconut fiber can slow the physiological disturbances and damage to parts of the anatomy of leaves on mesophyll section. No difference stems Anatomy *Alocasiamacrorrhiza* on all treatment and control groups on day 0 and day 15, so it can be ascertained that parts of the anatomy of the trunk does not change

In Table 4 it appears that after a 15-day there was an increase in total chlorophyll all treatments and decreased total chlorophyll in controls 200 and 400. The control Statistical tests show that there are real differences in the total chlorophyll between each treatment and control.The decrease in total chlorophyll in plants controls 200 and 400 control due to the concentration of 100% waste directly absorbed into the soil and plants without any filter. Chromium metal causes biochemical changes in the synthesis of chlorophyll. This change is due to inactivation of the enzyme in chlorophyll biosynthesis pathway that reduced levels of chlorophyll in most plants under exposure to chromium (Paiva et al., 2009). Therefore, there is a decrease in total chlorophyll in plant control.

Table 4. Chlorofil Content

Treatment	Chlorophyll Total Day-0	Chlorophyll Total Day-15
A1B1	15,02±0,02	18,96±0,01^{a}
A1B2	15,02±0,02	27,22±3,70^{b}
A2B1	15,02±0,02	22,52±0,44^{c}
A2B2	15,02±0,02	17,24±0,02^{d}
K200	15,02±0,02	6,60±0,04^{e}
K400	15,02±0,02	9,18±0,01^{f}

Alocasiamacrorrhiza plant biomass decreased in the interval of the study. However, the decline of biomass does not occur in the treatment of A1B1. In the treatment of A1B1 an increase in plant biomass into 203.47 gr. The increase in plant biomass due to growth *Alocasiamacrorrhiza* good and just having a bit of abiotic stress that the number of strands of leaves more than the other treatments.

The decline in biomass due to interruption of growth in *Alocasiamacrorrhiza*. The morphology, growth disorders can be seen from the leaves with symptoms of stress in the form of wilting and death of the leaf blade. Although the leaves *Alocasiamacrorrhiza* experiencing wilting or death, new shoots continued to grow during the 15 day study period.

Treatment	Plant Biomass Day-0	Plant Biomass Day-15
A1B1	200,00±0,00	203,47±41,06[a]
A1B2	400,00±0,00	266,10±73,81[a]
A2B1	200,00±0,00	108,80±18,75[b]
A2B2	400,00±0,00	374,63±99,13[c]
K200	200,00±0,00	121,70±0,00[b]
K400	400,00±0,00	359,10±0,00[c]

4. CONCLUSION

The addition of coconut fibers in tannery solid waste does not affect the effectiveness of chromium phytoremediation and supportplants can survive longer than those not given the addition of coconut fiber

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