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The Robusta coffee grounds residues to adsorb the heavy metal Lead (Pb) in the water

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The Robusta coffee grounds residues to adsorb the heavy metal Lead (Pb) in the water

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Abstract. Lead (Pb) were toxic. Lead found in pipes, batteries, paint, dyes ceramic glaze, gasoline, and final waste disposal. The robusta coffee grouds residues had high carbon, nitrogen etc which can adsorb heavy metal.The purpose of this study is to analyze the robusta coffee grounds residues to adsorb the Pb in the water. The method of this research is a True Experimental using completely randomized design (CRD) method. There were control groups (C) and three treatments groups (T1; T2;T3; 5gram/ litre; 8gram/ litre; 10gram/ litre) with six repetitions. The robusta coffee ground residues were contacted for 2 hours.Total samples were 24 samples which analyzed each parameter of the Pb with Atomic Adsorption Spectophotometry Analysis. The results showed that the more coffee ground residues that are exposed, increasingly turbid. The KS test showed that data were a normal distribution (sig=0,324). One way ANOVA test; Turkey post Hoc showed that there was sig difference between the control and treatment (F=4,326, Sig= 0,017). There were sig difference between control and treatment 2 and 3 (Sig=0,019; Sig=0,038). Robusta coffee grounds residues can reuse to adsorb the Pb pollution in the water. It can be a solution for treating the lead pollution in the water because of it easy to the application.

1. Introduction

Lead (Pb) is a toxic heavy metal. Lead can polluted the environmental bacause of naturall and antropologic activity. Lead found in pipes, batteries, paint, dyes and ceramic glazes, gasoline and were founded in final waste dispossal [1]. Lead is hard to degradate in the environment, unfortunatelly lead spread anywhere [2] [3]. The lead stay constantly for many years. Lead is toxic for human and other organisme. it can accumulate and give affected our health. Lead can caused death, systemic, immunologic, reproductive, and genetic effect. Lead often entered to our body by water that had been contamination [4].

Organic waste may use to adsorb the lead in the pollution water. Indonesia is the third larges produce coffee in the world. The area of Indonesia`s coffee plantation reach 1,3 million hectares (Ha) with productivity of 0.75 tons per hectare [5]. Jember is distric that produce alot of coffee in Indonesia. The types of coffee produced are robusta and arabica. But the robusta had been produced more than arabica coffee both with goverment and smallholding plantantion. Coffee consumption in the world shows the increase trend. The coffee consumtion in indonesia growth with the retail outlet. In Indonesia, the coffee comsumption increase since 2011 reach 0,87 Kg/ capita/ year and 1.15 Kg/ Capita / year in 2016 [6].

The high consumption of coffee in the community increase the amount of coffee waste in the environment. Some organic waste had a potential to adsorb pollutants, especially organic waste which high carbon. Coffee ground were contain total carbon 47,8-58,9%; total nitrogen 1.9-2.3%; protein 6.7-13.6 g / 100g; ash 0.43-1.6%; cellulose 8.6% [7]. The treatment of lead water pollution required hight cost. Using the organic waste such like a coffee ground to adsorb the lead in the water may be the solution for the this pollution. This research want to analysis the robusta coffee ground residues to adsorb the lead in the water.

2. Material and Method

2.1 Material.

Coffee grounds : Coffee powder had been brewed with boiling water for almost 10 minute and take the coffee grounds residues as a waste material. Drying coffee grounds in the sun almost 2 days till dried and then shifting 100 mesh to get the the coffee grounds in the same size. (Figure.1)

Water : using water from wells around the final waste disposal that polluted lead.

The dried coffee grounds residues had been contacted to the water in 0 gram/ litre (control), 5 gram/ litre (Treatment 1), 8 gram/ littre (Treatment 2) and 10 gram/ litter (Treatment 3) for 2 hours.

a. Robusta Coffee powder b. Brewed boliling water c. Dried coffee grounds d. Shifting coffee grounds

Figure 1. The material of the coffee ground

2.2 Method

This research is a True Experimental research using completly randomized design (CRD) method. There was control groups (C) and three treatments groups (T1; T2;T3; 5gram/ litre; 8gram/ litre; 10gram/ litre) with six repitition in every groups (Figure.2). The material of robusta coffee ground residues were contacted for 2 hours (Figure. 3). Total sampels were 24 samples which analysed each parameter of Pb with Atomic Adsorbtion Spectophotometry Analysis. The analysed Pb were in the

national accredited laboratory Indonesia. The SPSS 20 were use analysed data. The first, data was analysed with Distribution Normality test and then use the one way anova test after the turkey F test. Replication and Repetition:

$$(r-1)(t-1) \geq 15 \quad \text{....(1)}$$

$$R = r \times t \quad \text{....(2)}$$

Figure 2. The operational research framework

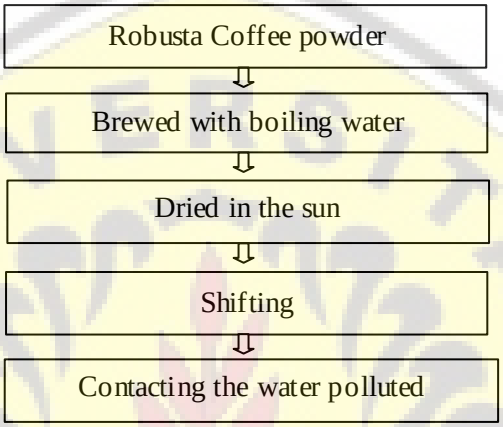

Figure 3. The operational research framework

3. Result and Disscusion

The water physic quality were observed for 2 hours. The control groups showed that the water still colourless. The treatments groups 1 showed that more blakened than control groups. The treatment groups 3 showed the the water physic quality were the most blakened. The more coffee grounds make the water colour. Robusta coffee ground residues had dark brown colour, and It colorized the water.

The mean of the lead in the control groups were 0,0035 ppm. The higest lead was in the replication 1 (0,005 ppm) and the the lowest was in the replication 5 (0,002 ppm). The treatment group 1 were contacted the coffee ground 5 gram into 1 litter water. The mean of the lead in the treatment groups 1 (5 gram/ litter) were 0,0023 ppm. The higest lead was in the replication 6 (0,005 ppm) and the the lowest was in the replication 1,3 and 4 (0,002 ppm). The groups which contacted the coffee ground 8 gram/ littre (group treatment 2), were had the higest lead in the replication 1and 4 (0,003 ppm) and the lowest were in the replication 2,3, 5 and 6 (0,002 ppm). The mean of the treatment group 2 was 0,0018 ppm. The mean group treatment 3 (10 gram/ litter) showed 0,002 ppm, which the higest were replication 6 (0,003 ppm) and the lowest was in the replication 1 (0,001 ppm) (Figure 4,5).

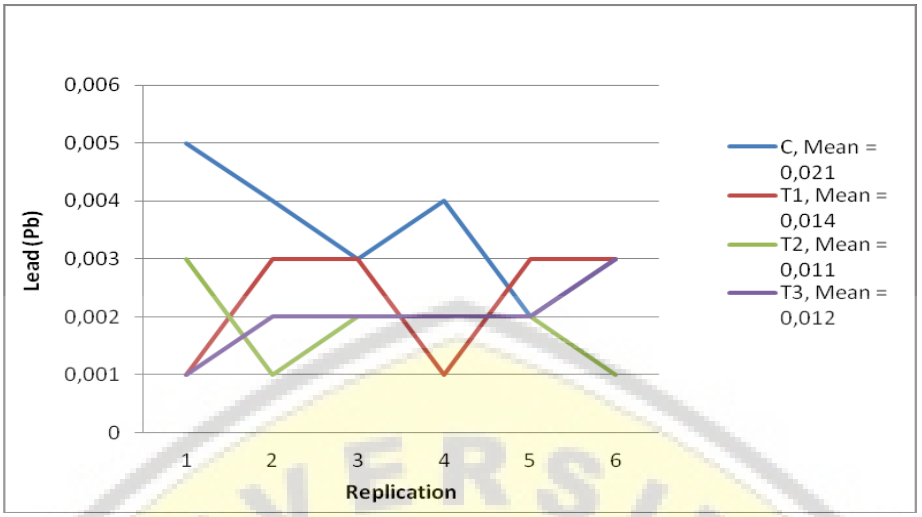

Figure 4. The lead in control groups and treatment group 1, 2, 3

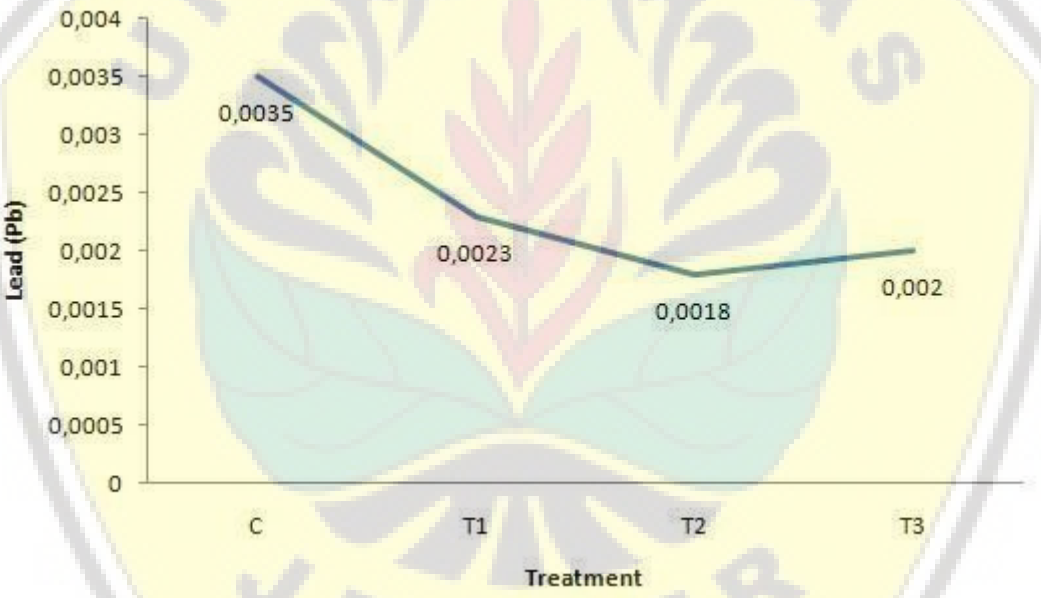

Figure 5. The mean of the lead (Pb)

The mean Pb in control group is the highest, and the lowest Pb is in the treatment group 2. It`s means that robusta coffee ground residues can adsorb the Pb pollution in the water. The mean Pb in the treatment 1 was 0,0023 ppm and treatment 2 was 0,0020 ppm. The grafic was fluktuatif. The grafic (Figure. 4) showed that the mean of Pb was decrease with contacted the coffee ground residues (control group compare with treatment 1, treatment 2), but little bit increase in the treatment 3. The mean Pb were decrease when contacting the coffee grounds for 2 hours. The decline of lead in contact 5 gram/ litter, 8 gram/ litter and 10 gram/ litter were 34,29 % , 48,58 % and 42,85%. (See table 1). The optimum decrease mean of lead was contacted coffee grounds in 8 gram/ littre. It may occur because of adsorbsi-desorbsi mechanism of the robusta coffee grounds. The organic adsorbent such robusta coffee ground have the capacity to adsorb the heavy metal. If they reach the maximum adsorbtion, then desorbtion mechanism was applied. The coffee ground residues were organic material that may had variety to adsorb heavy metal. The age of coffee seed, type of soil, time of harvesting etc. They may cause the fluctuatif grafic Pb, As a waste coffee ground.

Table 1. The mean of lead (Pb) degre in the control group and TI, T2, T3

Treatment	The degree of lead (%)
Control	-
T1	34,29
T2	48,58
T3	42,9

Pb still entered the body from the aquatic polluted [8]. Lead should be not in the environment, because lead is non essential metal that is very toxic on the enviroment and organism. Lead very toxic for fetus. Lead in bone release into blood during pregnancy and poisoneous fetus [9], That shouldnt happend. Lead very toxic for neurotoxicity, neuro development, genotoxicity [10], intelligence, attention, language, motor skills, memory executive functioning, processing speed, visuospatial skills, and affect mood [10], dental carries [11] and cause osteoporosis [12].

The toxicity of lead make the Indonesia goverment set the regulation standart for Pb in the water became increasingly tight because of their toxicity. The Indonesian`s regulations required that lead (Pb) on drinking water should less than 0.05 mg/L (Health Minister Regualation 416/1990). Then, the Indonesian`s goverment state that Pb in drinking water should had maximum limit 0.01 mg/ L (Health Ministrer Regulation Number 907/ 2002.), and reassigned on the regulation for Pb in the drinking water (Health Ministrer Regulations No.492/2010). As the World Health Organisation (WHO) maximum permissible limit is 0.01 mg/L [16]

The increasingly tight regulation of lead standart is the prevention to counter the entered lead to the environment, food chain that affected the human health. The toxic of lead should be controled. The lead polluted needs high cost to maintainance. Using the organic material can be choose to adsorb the lead in the polluted water.

The result of Kolmogorof smirnof test, data were normal distribution (sig=0,324). After used the Kolmogorof smirnof test, data were analysed with the One Way Anova test to identified the differences control groups and treatments groups.

The result of One Way Anova test showed the sig difference between control groups and treatment groups (F=4,326; Sig= 0,017). The Post Hoc turkey showed that control groups were sig differential with treatment groups 2 (sig =0,019) and treatment groups 3 (sig=0,38), but there was not Sig between control groups and treatment groups 1 (0,136). (table 2)

Table 2. The standart deviation of control and treatment groups.

	N	Standar Deviation
Control	6	0.0010488
T1	6	0.0010328
T2	6	0.0007528
T3	6	0.0006325

Treatment groups 1, which contacted coffee ground residues 5 gram/ littre were not sig to adsorb the Pb, although the decreased were 34,29%. The treatment 1 is less of coffee grounds residues than treatment 2 and 3. The amount of adsorbent correlate with the their ability to reduce the lead. The treatment 2 (8 gram/ littre) and treatment 3 (10 gram/ littre) were Sig to reduce the lead. It means that coffee grounds adsorb the lead, when the amount were 8 gram/ littre which leaad decrease 48,58% and 10 gram/ littre which decrease 42,9%.

The heavy metal in the aquatic can degradage with use phytoremediation or adsorbent. The phytoremediation can use the plant such hemp (Cannabis sativa) [17]. Some organic mater residues were good adsorbant for heavy metal polluted. The cacao plantation that produced the pod rind waste can adsorb the lead (Pb) and Cadmium (Cd) [18]. The coffee grounds also can use to adsorb some chemical compound such dyes [19] acid dye Red 44 [20].

This research showed that the robusta coffee grounds residues had the ability to adsorb the lead pollution on the water. Robusta coffee grounds residues as a waste can reuse to adsorb lead. Some research showed that coffee grounds effective binding Pb (II) ions in the water [21]. The coffee grounds can adsorb the Cu (II) dan Cr (VI) [22] and adsorb As (v), Cu (II) dan P (v) [23] in the aqueous. The dried coffee grounds also can adsorb Pb, Cr and Cd [24]

The adsorbsi- desorbsi occures caused by the mechanism of ion exchange of the heavy metals [25]. The Adsorbtion of heavy metal Cu2+, Zn2+, Cd2+ and Pb2+ depend on pH [26], and also the temperature affected the the adsorbent to adsorb the lead in the aqueous [27]. The increasing pH dan dosage of coffee residues were increased the removal of heavy metal [28]. The other research showed that coffee powder can adsorb Pb in the aqueous with pH optimum 5-7 [29].

4. Conclusion

The robusta coffee grounds residues as a waste from Jember, Indonesia can adsorb the lead pollution in the water. The robusta coffee grounds residues can controled the lead pollution from environment, adding the economic value for waste and economically for the treatment the polluted water.

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