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ACTIVATED CARBON OF GELAM WOOD LOWERS THE METAL CONTENT OF PAPUYU FISH IN THE ALALAK RIVER

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A B S T R A C T

Alalak River is a river that has high industrial activity, so that the lead metal content due to industry in this Alalak river is very high, which is 0.405 mg/Kg in papuyu fish that live in the river. There needs to be an effort in reducing metals, one of which is with compounds that have adsorption properties such as gelam wood plants. Gelam wood is a plant that is widely found, especially in the South Kalimantan area, this wood has a cellulose value of 76.8% and the ability to absorb iodine of 791.59 mg/g. The purpose of this study was to test the characteristics of the ability of gelam wood activated carbon in reducing lead (pb) levels in papuyu fish in the Barito river and see the effect of time variance in reducing lead (pb) levels. This research method is a true experiment to determine the effect of lead (pb) reduction activity in different exposure times. This study used a control group and a test group with exposure in several variations of contact time with gelam wood activated carbon.The results showed that the characteristics of gelam wood activated carbon were in accordance with the provisions of the Indonesian National Standard (SNI). While the significance value of the decrease in lead (pb) levels with exposure to activated carbon in gelam wood is <0.05 so it can be concluded that there is a significant effect on the decrease in pb levels.

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INTRODUCTION

The alalak river is one of the rivers in South Kalimantan surrounded by industries such as playwood / wood and the Pertamina industry which is still active today, in addition to industrial activities, the people of the alalak river use the river to wash motor vehicles, buy and sell sand and rocks, collect rattan, scavenge garbage, wash latrines in the river. Most of the alalak river community sources of search are papuyu fish farming which has advantages including expensive prices, easy to maintain even in places with limited water conditions and low water quality, so that papuyu fish become a superior commodity because of its high economic value (Hanafie et al., 2021) .

Papuyu fish are commonly found in rice fields and ditches (Akbar, 2021), also in ponds that get water or are associated with open waterways. Papuyu fish in spawning like places in swamps in habitats that are overgrown with beetle plants (*Gramineae*), but the high industrial activity has a negative impact as previous research by researchers on Lead Metal Content in Water and Papuyu Fish in the Alalak River Area obtained the results of research on the content of papuyu fish obtained papuyu fish meat of 0.405 mg / kg (Alawiyah & Rahmadani, 2021). According to the Regulation of the Head of BPOM RI No. 05 of 2018 the maximum limit of heavy metals in each fish is 0.20 mg / kg (Pb), this shows that the lead content of papuyu fish in the Alalak River exceeds the provisions of the regulation (BPOM, 2018).

Lead or often called lead in Latin is known as *lead*, abbreviated as Pb. Lead on the periodic table is found in group XIV P, period VI, has atomic number 82 with an atomic weight of 207.20 g / mol (Dian Yuni Pratiwi, 2020). Lead heavy metal (Pb) that enters the waters as a result of human life activities can take various forms. Among them are the wood industry, fuel oil, shipping, which will damage the aquatic environment thatpasses through it(Anggriani et al., 2021). Environmental pollution caused by heavy metals is a serious problem, one example of heavy metals that can pollute the environment is Lead (Pb) (Satria et al., 2018). Pb metal by its toxic properties can have an impact on health and can result in death (Ifa et al., 2020). Efforts to reduce heavy metals in waste need to be done so that industrial pollution waste does not pollute the environment too much when discharged into water bodies. Research is currently being promoted on the use of alternative adsorbents of natural origin. One alternative that can be done to reduce lead heavy metal levels is by adsorption using adsorbents on activated carbon (Jellali et al., 2022) so that the effectiveness of absorption of Pb metal ion content is due to the adsorption process by activated carbon

Activated carbon is a porous solid which contains about 85%-95% carbon (C). In the activation process, new pores are also formed due to the erosion of carbon atoms through heating (Anggriani et al., 2021). Activated carbon can reduce harmful compounds such as ammonia, the results of research by previous researchers found that activated carbon banana peels can reduce ammonia by 97.68%. In powdered activated carbon, the more surface area of the adsorbent pore, the greater the adsorption power. Activated carbon with a large surface area can be used in various applications, namely as color remover, deodorizer, deodorization in industry, water purification processes both in the process of drinking water production and in waste handling, one of the plants that has the potential as activated carbon is gelam wood

Gelam wood (*Meleleuca Sp*) a plant that is often used in the utilization of house piles and has high economic value with the potential results of large wood every year, this wood grows in swampy lowlands, sold at a relatively cheap price and easy to get (Basyaruddin1,

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Alnovia Suryaningsih2, 2019). Another benefit of this gelam wood is that it has the ability as activated carbon. According to research by Sirajudin stated that activated charcoal gelam wood can provide iodine absorption of 791.59 mg / g (Sirajuddin & Lestari, 2020). This shows that the amount of activated carbon absorption in gelam wood is able to absorb cation compounds. Metallic cations can become negatively impacted contaminants such as lead metal (Pb) contamination.

The results of research by Ulfa, et al showed that the efficiency of activated carbon of 1.5 grams for 40 minutes was able to provide optimum absorption of 85.60% for Pb metal (Anggriani et al., 2021). Ayu's research in 2018 stated that the average lead content (Pb) after treatment with variations in the thickness of coconut shell activated charcoal gave the average effectiveness of reducing lead weight levels with granulated coconut shell activated charcoal media with a thickness of 4 cm, 8 cm, 12 cm, 16 cm, and 20 cm respectively by 5.94%; 8,15%; 13,59%; 18,26%; 27,26% (Anggriani et al., 2021), So from the description above, further research is needed to see the Efficiency of Gelam Wood Activated Carbon (Melaleuca Sp) and Adsorbent Potential Test in Reducing Lead Levels in Papuyu Fish in the Alalak River Area

RESEARCH METHODS

1. Instrumen and material

Instrumen used Oven (Memmert), Furnace (Muffle Furnace), Sample Bottle, Volume Pipette (Pyrex), Digital scale (vernier VEB 2000 C), Atomic Absorption Spectrophotometer (SSA) (BioBase), PVC Pipe, Filter Cloth, Beaker glass (Pyrex), Sieve (ABM), Spray bottle, Porcelain dish, labe paper;, filter paper, Erlenmeyer, test tube, furnace. The materials used in this study are: gelam wood, aquadest, HNO 3, H 2 SO 4 concentrated, HCLO 4, NaOH, H 3 PO $_4$ 10%, HCl, KOH, pH paper, Na_2CO_3, ethanol 70%, iodine methylin blue . PA lead nitrate solution, papuyu fish from alalak river.(Alawiyah & Rahmadani, 2021) (Alawiyah et al., 2021).

2. Research design

This type of research uses *experimental* research design conducted with post *test only control design*. Fish samples that have been destroyed are divided into two groups in this design, namely the control group (without treatment) and the group with treatment.

The Course of Research

a) Sample preparation

Papuyu fish samples were obtained from the catches of people in the Alalak River, then each fish was weighed and given running water. Papayu fish that have been weighed are divided into 3 for 5-6 grams equally then exposed directly to papuyu fish meat with activated carbon of gelam wood as much as 1 gram each and waited according to time variations of 30, 60, and 90 minutes (Haditya et al., 2021)

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b) Activated carbon preparation

The gelam wood is sorted from impurities and cut uniformly into small sizes, then dried in the sun until completely dry for 7 days, followed by ovening at 60^{o}C for 24 hours. The formed gelam wood simplisia is mashed with a blander, then burned (carbonized) using tarur at a temperature of 600 for 1 hour. Charcoal sifted with a 70 mesh sieve (Alawiyah et al., 2021)

The activated carbon of gelam wood that is formed is followed by chemical activation by weighing 40 grams in contact with a solution of HCl 1 M to 500 ml then stirred using a magnetic stirrer for 10 minutes and then allowed to stand for 24 hours until it forms filtered using whatman 41 paper, then washed using NaOH and aquadest until neutral pH (Alawiyah et al., 2021)

c) Test characteristics of activated carbon of gelam wood

Feasibility tests as adsorbents are:

1) Water Content Test: an empty cup is weighed first, then 1 gram of gelam wood activated carbon is inserted and the weighing results are recorded. The moisture content obtained from the weighing result is calculated as the weighing result
2) Ash Content Test: an empty cup is weighed first, then put 1 gram of gelam wood activated carbon in a 600oC sow for 1 hour observed and record the weighing results. Calculate the ash content obtained from weighing results
3) Iodine Absorbency Test: 1 gram of activated carbon is soaked in 25 ml of iodine for 15 minutes and then filtered, 10 ml of filtrate produced and put into Erlenmeyer. Then the filtrate is titrated with sodium thiosulfate until it is light yellow. Calculate the absorption of iodine produced from the titration results.
4) Methylene blue absorption test: inserted 200 mg methylene blue dissolved in water, then put 250 mg activated carbon, observed the clarity of the solution that occurs

d) Manufacture of lead working solution

Lead Nitrate master solution of 100 ppm is pipetted and put each into a 100 ml measuring flask and added distilled water and tara to the limit of the flask homogenize the solution until the concentration becomes 0, 2, 4, 6, 8, 10 and 12 mg / L and given a code for each of these working solutions.

e) Lead drop check

The examination is carried out by the Atomic Absorption Spectrophotometry method. To determine the effectiveness of reducing monia levels can be done with the following formula:

$$Ef = \frac{Co - Ci}{Co} \times 100\ \%$$

Fyi: Co: Initial Concentration

Ci: Final Concentration

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Data analysis in this study is *One Way Anova* which is used to determine whether there is a significant difference or not between giving activated carbon at 30, 60 and 90 minutes with giving activated carbon to reduce lead levels in papuyu fish in the alalak river.

RESULTS AND DISCUSSION

The results of previous studies stated that the lead heavy metal content in papuyu fish amounted to (Alawiyah & Rahmadani, 2021), So it is necessary to reduce the metal by exposure to Akif carbon absorent. This research began with the manufacture of activated carbon gelam wood. The process of making activated carbon of gelam wood is divided into three, namely dehydration, carbonization, and activation stages. The initial process is dehydration which aims to eliminate water content (Dewi et al., 2021) in the raw material by cutting small logs and drying in direct sunlight for seven days, then continued with the carbonization process to remove impurities and open the pores of activatedcarbon of gelam wood and the last process is activated by dehydration using akivators such as NaCl, Ca (OH), $MgCl_2$, HNO_3, HCl, KOH, ZnCl2, H3PO4 (Fanani, N dan Ulfindrayani, 2019).

Figure 1. Activated Carbon Gelam bark

Activated carbon from the bark isthen tested for the characteristics of activated carbon which can be seen from the moisture content test, ash content test, iodine absorption test and *methylin blue* absorption test. These results can be seen in the table;

Table 1. Results Characteristics of Activated Carbon

No	Test	Result
1	Water content	3,17 %
2	Ash content	4,32 %
3	Iodine absorption	912,17%
4	*Metilin blue*	Clear

Quality tests in a carbon must meet the standards stipulated as absorbents including, moisture content, ash content and iodine handover based on SNI. The results of the calculation and analysis of the gelam wood activated carbon above found that the activated carbon has met good quality standards. The results in this study obtained water content of 3.17% this is appropriate, Activated carbon has hygroscopic properties so that it can easily absorb moisture from the air, in activated carbon the value of water content is expected to

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have a low value because, because high water content can reduce the absorption of activated carbon (Dewi et al., 2021)

The results of the gelam wood ash content test obtained are 4% this result is in accordance with the quality of activated carbon quality, which is lower than the quality threshold of 10% or has met the standards set by SNI 06-3730-95, the purpose of determining carbon ash in activated carbon is to determine the metal oxide content of activated carbon, the lower the ash content, the less inorganic content contained in the activated carbon and the lower the content More Effective as a Heavy Metal Adsorbent (Rahman et al., 2020)

The iodine absorption test aims to test the ability of activated carbon to absorb molecules that will be contacted with activated carbon. The results of iodine absorption testing by gelam wood activated carbon were obtained at 912.17%, this result met SNI 06-3730-1995 standards, which is more than > 750 mg / g. the greater the iodine absorption capacity or greater than 750%, the better the activated carbon in heavy metal absorption, the high iodine absorption value illustrates the number of micropore structures formed (Puspitasari et al., 2017).

Quantitative test

a. Lead nitrate wavelength screening

In this study, lead nitrate wavelength screening was carried out with a concentration of 1000 ppm and measured using a UV / VIS spectrophotometer instrument at a vulnerable wavelength of 200 – 400 nm and obtained a maximum wavelength value of 283.3 nm

b. Lead nitrate calibration curve

Determination of the lead nitrate calibration curve was carried out by making 100 ppm Furthermore, diluted in the standard series of 0, 2, 4, 6, 8, 10 and 12 measured at a maximum wavelength of 283.3 nm, the results are as follows:

Table 2. Lead nitrate Calibration Curve Results

No	Concentration (ppm)	Absorbansi
1	0	0
2	2	0,0396
3	4	0,079
4	6	0,1176
5	8	0,1538
6	10	0,1902
7	12	0,2294

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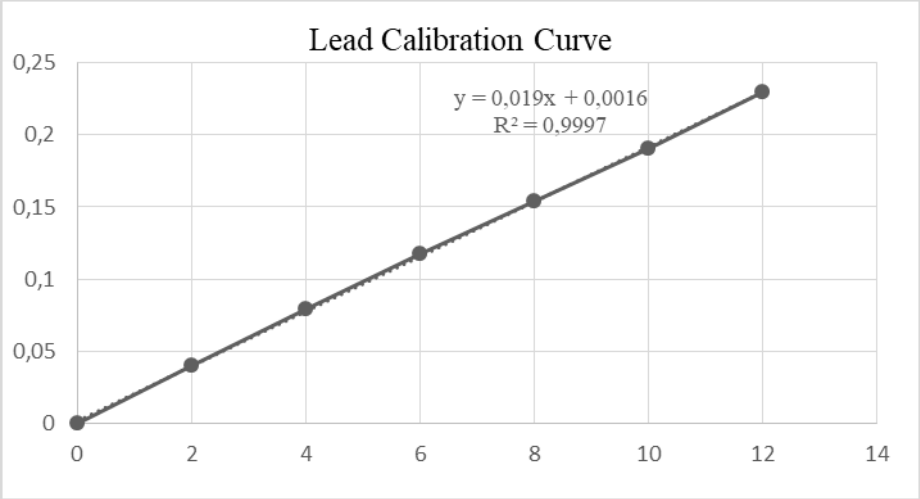

Figure 3. Lead solution calibration curve

Quantitative testing to measure lead metal (Pb) levels in samples was performed using Atomic Absorption Spectrophotometry (SSA) with a wavelength of 283.3 nm. The results of measuring the absorbance value of the curve obtained a correlation coefficient (r) value of 0.9997 which means that it meets the conditions set by SNI, namely the correlation coefficient value must be ≥ 0.995. The absorbance value is then made a relationship curve between the concentration value (x-axis) and absorbance (y-axis) with the formula y= bx + a then determined the level through sample absorbance in the equation and can be seen in table 3 (Results of the calculation of lead content in papuyu).

In the papuyu fish sample 1 control group the lead content obtained was 6.008 mg / Kg, after exposure to gelam wood activated carbon for several time variations, the lead content results in the 90-minute group were obtained which was 0.490. While in the samples of papuyu fish 2 control groups lead levels were obtained 8.025 mg / Kg, after exposure to activated carbon gelam wood in several time variations, the results of the 90-minute group obtained results of 0.220 mg / Kg. In fish samples 3 control groups obtained lead content levels in papayu fish of 6,311 mg / Kg while after exposure to gelam wood activated carbon with various time variations, the results of the 90-minute group in fish 3 obtained results 0.654 mg/Kg. This result is while research conducted by (Ulfa, et al in 2021) is, The optimum contact time in the Pb (II) adsorption process is 40 minutes with an activated carbon mass of 1.5 grams. Optimum absorption efficiency of 85.6050% for Pb (II) metal absorption is obtained (Anggriani et al., 2021)

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c. Calculation of lead levels in papuyu fish

Table 3. Results of Calculation of lead content in papuyu fish

Sample	Group	absorbance	Consemtration (mg/L)	Lead content (mg.Kg)
Papuyu Fish I	Control	0,233	12,179	6,008
	30 minute	0,155	8,056	3,792
	60 minute	0,075	3,863	1,793
	90 minute	0,020	0,986	0,490
Papuyu Fish II	Control	0,311	16,267	8,025
	30 minute	0,177	9,232	4,345
	60 minute	0,051	2,600	1,207
	90 minute	0,010	0,442	0,220
Papuyu Fish III	Control	0,245	12,793	6,311
	30 minute	0,143	7,442	3,592
	60 minute	0,080	4,144	1,980
	90 minute	0,028	1,389	0,654

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d. Decrease in lead levels in papuyu fish

Table 4. Results of reduced lead levels in papuyu fish

Sample	Group	Decline (%)
papuyu fish I	Control	0
	30 minute	36,88
	60 minute	70,15
	90 minute	91,84
Papuyu Fish II	Control	0
	30 minute	45,85
	60 minute	84,96
	90 minute	97,26
Papuyu Fish III	Control	0
	30 minute	43,09
	60 minute	68,63
	90 minute	89,64

The next stage is to calculate the percentage reduction in lead heavy metal levels in papuyu fish that have been added activated carbon can be seen in table 4 (Table of decreases in lead levels in papuyu fish), from these results group 1 papuyu fish after being exposed to 90 minutes of activated carbon gelam wood decreased lead levels of the fish decreased by 91.84%. In papuyu fish 2 the decrease in lead metal levels after exposure to gelam wood activated carbon decreased by 97.26%, while in papuyu 3 fish the results of a decrease in lead metal levels after 90 minutes exposure were exposed to gelam wood activated carbon to 89.64%. This shows that there are differences in lead heavy metal content in river water with variations in feeding (Alawiyah & Rahmadani, 2021)

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Table 5. Results of data analysis

ANOVA

Decrease in Pb

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	14965.342	3	4988.447	169.282	.000
Within Groups	235.746	8	29.468		
Total	15201.088	11			

The results of the Anova test get a result of <0.001, which is 0.000324 which means a Ha value of <0.05. Ha is a hypothesis that states there is a relationship between one variable and another variable or a hypothesis that states there is a difference between one variable and another. So that these results can be concluded that there is a significant difference between the difference in the length of exposure to gelam wood activated carbon on reducing lead metal levels in papuyu fish, the hypothesis is accepted.

CONCLUSIONS AND SUGGESTIONS

The results of testing the characteristics of activated carbon of gelam wood obtained the results of moisture content of 3.17%, ash content of 4.32%, iodine absorption of 912.17%, this is in accordance with SNI (SNI 06-3739-95). Gelam wood activated carbon was able to reduce lead heavy metal levels in papuyu fish 1 with a decrease of 91.84%, in fish 2 a decrease in lead metal by 97.26% and in fish 3 a decrease in lead metal obtained a result of 89.64%. The results of the hypothesis concluded that there was a significant difference between the difference in the length of exposure to activated carbon of gelam wood on the reduction of lead heavy metal levels in papuyu fish in the Alalak River area

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