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EFECTIVENESS OF ZEOLITE AND ACTIVATED CHARCOAL SYNERGY AS LOUSE REPELLENT MATERIAL IN HAT

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ABSTRACT

Head louse are a classic problem that greatly concerns the public as they suck blood in the area around the head and cause itching. This research aims to create a hat that can reduce the number of head louse. The research method used a quantitative method. Data collection was conducted using an anti-louse activity test using goat legs with head louse placed on them and an efficacy test involving respondents who had louse problems with a prevalence method. Data analysis used comparative descriptive analysis and linear regression with SPSS. The results of anti-louse activity test using prevalence method showed that the repellent power of zeolite and activated charcoal was 81.67%. The correlation value was 80.9% with an influence level of 65.4%. The F value > df, indicating that the hypothesis was accepted. The results of the ANOVA test showed a significance of 0.015, meaning that there was a significant effect of zeolite and activated charcoal in reducing the number of louse.

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Kata Kunci: Activated Charcoal, Hair, Hat, Louse, Zeolite

INTRODUCTION

Louse infestation is a classic problem that causes a lot of discomfort to people as louse suck blood in the scalp area, causing itching. According to Na'imah (2019), this itching sensation is actually an allergic reaction to the saliva of the louse. Prolonged itching, as stated by Kusumasari (2019), can potentially cause irritation on the scalp and even secondary infection by bacteria. This louse infestation is often referred to as pediculosis. According to Mayasin & Norsiah (2017), pediculosis is a scalp infection caused by Pediculus humanus var. capitis, resulting in itching and irritation on the scalp. Generally, it is caused by personal hygiene factors.

People usually manually handle louse infestation by using a fine-tooth comb. However, according to Kusumawardhani et al. (2019), the use of a fine-tooth comb is still not more effective than the use of permethrin in terms of healing parameters, but the use of a fine-tooth comb has been proven effective in reducing the level of louse infestation.

There are several louse medications commonly used, including permethrin. According to Hardiyanti et al. (2015), permethrin causes resistance problems that occur at high concentrations in areas that have previously experienced resistance to DDT or pyrethroids. Another synthetic substance is lindane, which is available in shampoo form. However, this substance is slower in killing louse and has side effects in the form of central nervous system disorders. Another substance is carbaryl, which is a cholinesterase inhibitor available in lotion and shampoo forms. However, this product is more toxic and carcinogenic in patients, even though it is not

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very effective in killing louse. In addition to carbaryl, malathion is a cholinesterase inhibitor commonly used to treat louse. All of these chemical medications have dangerous side effects on the body and have the potential to pollute the environment.

Therefore, despite the danger of louse infestation, the use of synthetic louse medication is also very dangerous when used. Hence, many studies are being conducted to develop natural pediculicides. However, according to Sulaiman & Pratiwi (2018), the effectiveness of natural pediculicides against head louse is still considered insufficient to be used due to factors that may cause louse to reinfest as before. Thus, it is necessary to conduct research on the use of other effective ingredients to repel louse without causing side effects.

LITERATURE REVIEW

One of the potential natural materials that can be used as a louse repellent is activated charcoal. According to Lempang (2014), activated charcoal has good adsorption properties for anions, cations, and molecules in the form of organic or inorganic compounds such as liquids and gases. Activated charcoal can be used to absorb toxins, heavy metals, gas emissions, and reduce microbial biomass. According to Dewi et al. (2020), activated charcoal has hygroscopic properties, allowing it to absorb large amounts of water vapor.

Another abundant material in Indonesia is zeolite. According to Kusdarto (2008), zeolite has several physical and chemical properties as an adsorbent, ion exchanger, molecule filter, and catalyst. Zeolite, according to Hasibuan and Marbun (2018), has good adsorption properties for water vapor in the air. Even Jaeni et al. (2011) have created a drying device for food and medicinal plant products using zeolite.

The combination of activated charcoal and zeolite has the potential to be used as a repellent for louse. When applied to a hat by placing a bag of activated charcoal and zeolite inside, it will cause a decrease in the moisture levels of the hair and scalp. According to Analdi & Santoso (2021), louse can only survive by feeding on human blood sucked through the scalp, warmth, and humidity from the human body. Louse, according to Tria et al. (2019), prefer to thrive on dirty, moist, infrequently washed, and infrequently combed hair. However, this activity does not harm the scalp and hair, as the scalp will always moisturize itself by producing oil. The role of zeolite and activated charcoal is to reduce the moisture levels, as excessive oil production on the scalp, according to Saraswati and Putriana (2017), can trigger dandruff growth and louse development.

METHOD

The research was conducted from April to September 2022 in Sampang District, Cilacap Regency, which included the making of hats, zeolite and activated charcoal pouches, side-effect testing using test animals in the form of cats, simulation testing using thick-furred goat leg sections, and efficacy testing involving several respondents who had louse infestations using prevalence methods. Data collection included observing changes in cat behavior in the side-effect test, louse behavior on goat hair treated with zeolite, activated charcoal, and a combination of zeolite and activated charcoal, as well as louse repellent testing by counting the number of louse remaining on the scalp after respondents used hats equipped with zeolite and activated charcoal pouches. Data analysis used descriptive analysis and Anova analysis with simple linear regression.

RESULT AND DISCUSSION

The application of zeolite and activated charcoal on hats is done by placing a pocket inside the top part of the hat. When the zeolite and activated charcoal powder that has been packaged in a pouch is used to repel louse, the pouch can simply be inserted into the pocket inside the hat. When it is deemed sufficient, it can be removed from the pocket inside the hat. Therefore, if the hat is wet or being washed, the color of the activated charcoal will not stain the hat.

Subsequently, safety testing was conducted using test animals in the form of cats. The hat was specially designed so that it could be worn on the cat's head. After about 4 hours of use, the cat's behavior was observed.

Table 1. Product Safety Test

No	Parameter	Test Results
1	Cat Behavior	Behavior remains normal as usual
2	Cat Fur Condition	No fur shedding
3	Cat Health Condition	Cat is not experiencing any health problems

After it was proven safe, a simulation test of anti-louse activity was conducted using a dengkil (goat leg) as it has thick fur that is believed to make louse comfortable for a while.

Figure 1. Anti-Louse Activity Test with Goat Leg

Then, small, medium, and large louse were introduced to observe their response to zeolite, activated charcoal, and the combination of zeolite with activated charcoal for about 60 minutes. The experiment was repeated 3 (three) times.

In Table 2, it can be seen that zeolite, activated charcoal, or a combination of zeolite and activated charcoal can repel louse. However, some large louse did approach the activated charcoal, but after 1 hour, the large louse on the activated charcoal appeared unstable, moved away, and became still (did not move at all).

Based on the ANOVA test analysis, an F value greater than the degree of freedom was obtained, so the hypothesis was accepted. The significance was 0.009, which means $\alpha < 0.05$, thus there is an influence of zeolite and/or activated charcoal on louse repelling behavior. Based on simple linear regression analysis, a correlation between the presence of zeolite and/or activated charcoal and the louse repellent power of 71.2% was obtained, which means the correlation is quite strong. The influence of zeolite and/or activated charcoal on louse repelling behavior was 50.6%, which means it is quite strong. Therefore, zeolite and/or activated charcoal can be used to repel louse.

Table 2. Anti-Louse Activity Test with Goat Leg Medium

Trial	Treatment	Louse Response	Notes
1st	Zeolite	Moved away 2 cm	All louse, small, medium, and large moved away from the active substance
	Activated charcoal	Moved away 3 cm	
	Zeolite activated charcoal	Moved away 4 cm	
2nd	Zeolite	Moved away 3-7 cm	After 25 minutes, moved further away
	Activated charcoal	Moved away 4-5 cm	One large louse initially moved on the activated charcoal then moved away and remained motionless
	Zeolite activated charcoal	Moved away 4-5 cm	One large louse initially moved on the activated charcoal then moved away and remained motionless
3rd	Zeolite	Moved away 3-5 cm	After 12 minutes, moved further away
	Activated charcoal	Moved away 3 cm	
	Zeolite activated charcoal	Moved away 2-4 cm	

The next simulation test was continued using a hat that had been coated with a cloth containing zeolite and activated charcoal, compared to the control, which was a hat that did not have the addition of zeolite and activated charcoal.

Figure 2. Anti-louse simulation test using hats

Based on the observation, it is known that on average louse move away from the position of zeolite and activated charcoal. This behavior indicates that there is an effect of zeolite and activated charcoal on louse.

Each hat was placed with 2 louse and observed their behavior for 60 minutes. The results are as follows:

Table 3. Anti-Louse Test with Hats

Trial	Hat Type	Test Results
1st	Regular hat	1 louse spinning around on the top of the hat 1 louse moving up and down inside the top of the hat 1 louse disappeared
	Zeolite activated carbon hat	1 louse stayed on top of the zeolite/activated carbon and remained still
2nd	Regular hat	All louse remained on top of the hat, then moved to the seam fold
	Zeolite activated carbon hat	All louse moved away from the zeolite and activated carbon, then hid in the seam fold of the hat
3rd	Regular hat	1 louse near the hat's fabric adhesive The other louse hid in the seam fold
	Zeolite activated carbon hat	2 louse moved away from the zeolite and activated carbon, and the other louse immediately hid in the hat's seam fold.

The correlation between the presence of zeolite and activated charcoal and the repellent power of louse is 86.6%, with an influence level of 75%, which means it is very strong. The F value is greater than the degree of freedom, so the hypothesis is accepted, which means that the presence of zeolite and activated charcoal in the hat makes louse move away and not stay. With a significance level of 0.000, it means that $\alpha < 0.05$, which means that the presence of zeolite and activated charcoal in the hat is effective in making louse not stay.

Next, an efficacy test was conducted using the prevalence method by asking respondents who have louse to wear the hat for 3-4 hours, then combed to count the remaining louse on the head. After that, the number of louse was compared with the results of combing done before wearing the hat with zeolite and activated charcoal.

Table 4. Efficacy Test

Duration of Use	Number of Louse Remaining after Comb	
	Before	After
4 Hours	20 louse	3 louse
3 Hours	20 louse	5 louse
¾ Hour	5 louse	1 louse
3 ½ Hours	15 louse	2 louse
Average	**15**	**2.75**

Using the repellent power formula, the average ability of zeolite and activated charcoal in the hat to repel louse is 81.67%. The correlation between the use of zeolite and activated charcoal-infused hat and the reduction of louse count by 80.9% with a level of influence of 65.4% was observed. The F value was greater than the degree of freedom, indicating the acceptance of the hypothesis. The ANOVA test showed a significance of 0.015, which means $\alpha < 0.05$, thus there is a significant effect of using zeolite and activated charcoal-infused hat on reducing louse count. Indeed, respondents who used the zeolite and activated charcoal-infused hat felt uncomfortable during the first hour of usage due to a decrease in scalp moisture levels and the reaction of louse that started feeling uncomfortable. However, after 2 hours, it became normal as the scalp started adapting and louse began leaving the head of the person using the hat with zeolite and activated charcoal. Thus, this hat is effective in repelling louse.

CONCLUSION

The hat with the addition of zeolite and activated charcoal is safe to use based on safety tests using test animals such as cats. The results of the anti-louse simulation test using goat's legs showed a correlation value of 71.2% with an influence level of 50.6%. The F value was greater than the degree of freedom, indicating the acceptance of the hypothesis. The ANOVA test showed a significance of 0.0009, which means there is a significant effect of zeolite and activated charcoal in repelling louse. The simulation test using the hat resulted in a correlation value of 86.6% with an influence level of 75%.

The F value was greater than the degree of freedom, indicating the acceptance of the hypothesis. The ANOVA test showed a significance of 0.0000, which means there is a significant effect of the presence of zeolite and activated charcoal pockets in repelling louse. Based on these results, an efficacy test was conducted using the prevalence method. The efficacy test resulted in a repelling power of zeolite and activated charcoal of 81.67%. The correlation value was 80.9% with an influence level of 65.4%. The F value was greater than the degree of freedom, indicating the acceptance of the hypothesis. The ANOVA test showed a significance of 0.015, which means there is a significant effect of the zeolite and activated charcoal-infused hat in reducing louse count.

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