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THE GRADE 2 OF LIQUID SMOKE OF SOME AGRICULTURAL WASTE AS A NATURAL TERMITICIDE

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Abstract–The grade 2 of liquid smoke is known as a food preservative and for humans, but the information on the utilization of this material for termiticide has yet to be found. Aim of this research is determine of the grade 2 of liquid smoke from some agricultural waste that can use as a active ingredient of natural termiticide products. The research result suggests that liquid smoke coconut shell has the highest termiticide activity. The fact of highest termiticideactivity (100%) indicated that liquid smoke of coconut shell at a concentration level of 50% is the best of active ingredient termiticide. The loss of little weight of paper disc (2.50.4 mg) that is eaten by termites in the treatment of liquid smoke coconut shell at 50% were significantly different compared to the other treatments. This is presumably closely related to the toxicological properties of liquid smoke coconut shell to termites. Based on research result, as a conclusion, the liquid smoke of coconut shell at a concentration level of 50% is the best of active ingredient termiticide to be used in formulation of natural termiticide products.

INTRODUCTION

Termiticide commonly used to treat termite infestation is termisida based on synthetic materials. The use of termiticide synthesis is also thought to be bad for health and the environment. This is a challenge and an opportunity to create a natural termiticide cheap and safe for humans and the environment. The Liquid smoke has been known to have potential for termiticide natural active ingredients. The Liquid smoke can be obtained from agricultural biomass waste pyrolysis. The Liquid smoke is a result of condensation products of pyrolysis of materials containing a large number of compounds such as cellulose, hemicellulose and lignin. Results of pyrolysis of compounds will produce organic acids, phenols, and carbonyls are compounds that play a role in the preservation of foodstuffs. The compounds are different proportions depending on the type, material moisture content, and temperature of pyrolysis (Soldera, 2008). The grade 2 of liquid smoke is known as a food preservative. This material is safe for humans, but the information on the utilization of this material for termiticide has yet to be found. Aim of this research is determine of the grade 2 of liquid smoke from some agricultural waste that can use as a active ingredient of natural termiticide products.

MATERIALS AND METHODS

The materials are used in this study include: paper disc of pasteboard, aquadest, coconut shell, corncob, rice husk, filter paper, Cryptotermes cynocephalus.

Preparation of The grade 2 of Liquid Smoke

Coconut shell, corncob and rice husk used in this work was collected in March, 2016 from Amarasi Selatan, Kupang, Indonesia. The samples ware thoroughly washed and dried for 48 hours. Twenty kilograms of dry samples (coconut shell, corncob and rice husk) included to pyrolysis reactor and pyrolysis at 400 °C for 3 hours. Liquid smoke is collected in a glass container and allowed to settle for 10 days. The liquid smoke is filtered by using filter paper, then it is distilled at temperatures less than 220 °C.

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Essay of Termiticide Activities

This experiments were conducted in Laboratory of Integrated Research of the Nusa Cendana University. The method is adopted from (2011), Kareru *et al.* (2010) and Sahay *et al.* (2014). Prepared a paper disc of pasteboard with a diameter of 4 cm as bait for each experimental unit. Sheets of paper put in the oven at 40 °C for 10 hours. Then the sheets of paper disc ware soaked in liquids smoke with different levels of concentrations respectively 50%, 25%, and 10% for 20 minutes. As a control used sheets of paper soaked in distilled water. After that the sheets of paper was dried at room temperature. The sheet was placed test containers and then 20 termites (*Cryptotermes cynocephalus* Light) inserted into the test container. Each treatment was performed 5 replications for each concentration. The test containers ware placed in sealed containers with a base surface of the sterile sand. The sand was moistened by distilled water on a regular basis to maintain a constant of relative humidity. The number of live termites are counted after 48 hours or the experiment was stopped when the mortality rate in all treatment has reached 100% mortality. After testing, at day 6, papers disc of pasteboard were dried in an oven at 40 °C for 10 hours and weighed, and then the weight loss of each paper was calculated. Percentage of termites mortality was calculated by :

$$\%M = (T2/T1)\ X100\%$$

%M is percentage of mortality; T1 is total termites; T2 istotal mortality

RESULTS

Table 1 showed the percent of termite mortality after 48 hours of the treatment of liquid smoke of Coconut shell, corncob and rice husk.

Data analysis was focused at 48 hours after treatment of liquid smoke, base on the fact that the treatment of liquid smoke of coconutshell at a concentration level of 50% has shown mortality of termites on rate of 100%. Table 1 showed the termiticideactivity of liquids smoke of Coconut Shell, corncob and rice huskagainst *Cryptotermes cynocephalus*, at 50% of liquids smoke of Coconut Shell, corncob and rice huskhave showed termiticide activity against *Cryptotermes cynocephalus*. Liquid smoke of corncob and rice huskat 50%, Liquid smoke of Coconut Shell andrice husk at 25%, have shown termiticide activity, their

Table 1. Percentage of termite mortality after 48 hours

Treatment	Average of Termite Mortality (%)
control	0.00±0.00
ACBK 50%	100.00±0.00^{a}
ACSP 50%	90.00±7.07^{b}
ACBK 25%	86.25±13.77^{bc}
ACTJ 50%	70.00±14.72^{bc}
ACBK 10%	61.25±13.15^{c}
ACSP 25%	52.50±13.23^{c}
ACTJ 25%	36.25±16.52^{cd}
ACSP 10%	31.25±8.54^{d}
ACTJ 10%	8.75±6.29^{e}

ACBK: Liquid smoke of coconut shell; ACTJ: Liquid smoke of corncob; ACSP: Liquid smoke of rice husk

treatment cause 50% mortality of termites. Termiticide activities of liquid smoke of coconut shell has been seen since at 10% treatment where this treatment led to more than 50% mortality of the termites. On the other hand, liquid smoke of corncob and rice husk at 10% showed the lowest termiticideactivity.

Weight of paper disc was measurement on day 6, average of paper disc weight are showed on Table 2.

From Table 2 is known that lowest loss of the weight of paper disc on treatment of liquid smoke coconutshell at a concentration of 50%. The facts showed the termites still eat paper disc (2.50.4 mg). Facts showed that the termites still eat paper disc (3.60.4 mg) with liquid smoke coconutshell at 25%. Even termicide activity of liquid smoke coconutshell has been shown at 10%, where the termites should only take a bit of paper disc (7.40.5 mg).

Activities termicide of liquid smoke coconutshell is caused come from some compounds that

Table 2. Average of paper disc weight

Treatment	Loss of paper disc (mg)*
Control	10.6±0.6^{a}
ACTJ 10%	9.4±1.3^{ab}
ACSP 10%	8.5±0.9^{bc}
ACTJ 25%	8.3±0.4^{bc}
ACBK 10%	7.4±0.5^{c}
ACSP 25%	7.1±0.6^{d}
ACBK 25%	3.6±0.4^{e}
ACTJ 50%	3.4±0.4^{e}
ACSP 50%	3.2±0.5^{ef}
ACBK 50%	2.5±0.4^{f}

*at day 6; ACBK: Liquid smoke of coconut shell; ACTJ: Liquid smoke of corncob; ACSP: Liquid smoke of rice husk

Table 3. Contain of PAHscompounds in liquid smoke of coconut shell

Parameter	Result	Unit	Method
Naphthalene	77.04	µg/L	APHA 6440-PAH. B. HPLC
Acenaphthylene	58.68	µg/L	APHA 6440-PAH. B. HPLC
Acenaphthene	19.04	µg/L	APHA 6440-PAH. B. HPLC
Fluorene	<10	µg/L	APHA 6440-PAH. B. HPLC
Phenanthrene	<10	µg/L	APHA 6440-PAH. B. HPLC
Anthracene	<0.5	µg/L	APHA 6440-PAH. B. HPLC
Fluoranthene	<4	µg/L	APHA 6440-PAH. B. HPLC
Pyrene	<0.7	µg/L	APHA 6440-PAH. B. HPLC
Benzo(a)Anthrancene	<0.25	µg/L	APHA 6440-PAH. B. HPLC
Chrysene	<0.75	µg/L	APHA 6440-PAH. B. HPLC
Benzo(b)Fluoranthene	<0.5	µg/L	APHA 6440-PAH. B. HPLC
Benzo(k)Fluoranthene	<0.5	µg/L	APHA 6440-PAH. B. HPLC
Benzo(a)Pyrene	<0.25	µg/L	APHA 6440-PAH. B. HPLC
Dibenzo(a,h)Anthracene	<1.5	µg/L	APHA 6440-PAH. B. HPLC
Benzo(g,h)Perylene	<1.5	µg/L	APHA 6440-PAH. B. HPLC
Indenol(1,2,3-cd)Pyrene	<1.5	µg/L	APHA 6440-PAH. B. HPLC

contained in liquid smoke, particularly a group of Polycyclic Aromatic Hydrocarbons (PAH) compounds. Table 6 showed the results of the Analysis of PAH compounds in the liquid smoke coconutshells.

Naphthalene, Acenaphthylene, and Acenaphthene is the dominant compound in the liquid smoke coconutshell. These compounds are especially Naphthalene has long been known as a insects repellent**.**

DISCUSSION

The research result suggests that liquid smoke coconut shell has the highest termiticide activity. The fact of highest termiticide activity (100%) indicated that liquid smoke of coconut shell at a concentration level of 50% is the best of active ingredient termiticide. The loss of little weight of paper disc (2.50.4 mg) that is eaten by termites in the treatment of liquid smoke coconut shell at 50% were significantly different compared to the other treatments. This is presumably closely related to the toxicological properties of liquid smoke coconut shell to termites.

At first we assumed that PAHs compounds that content in liquid smoke of coconut shell is a compound causes the death of termites, but after reviewing some literature we begin to doubt this. Although it has long been known as an insect repellent, but yet it is certain that Naphthalene as a toxic compounds in liquid smoke of coconut shell that caused mortality of termite. Naphthalene is is accumulated in the nests of termites from the genus *Nasutitermes*. Research has acquired facts that some polycyclic aromatic hydrocarbons (PAHs) contained in termite nest as a large biological sources. Some research have found the hydrocarbon naphthalene in extracts of the nest material produced by Formosan subterranean termites. The naphthalene has been found as a natural defense of termite nests to control fungi. Perylene is found in all studied termite nests including six different genera. Phenanthrene occurs at substantial concentrations in termite nests (Chen *et al.,* 1998; Beverly *et al.*, 1998; Wiltz*et al.*, 2000). Further research is needed to determine the content of liquid smoke of coconut shell that can cause death of termites.

CONCLUSION

Base on research result, as a conclusion, the liquid smoke of coconut shell at a concentration level of 50% is the best of active ingredient termisida to be used in formulationof naturaltermiticide products.

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