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Forewords

Praise and gratitude to Allah SWT, because of Allah's love for us so that we are still given a long life and can carry out our various daily activities. May all our activities become our acts of worship, Aamiinnn

in accordance with the commitment of the Jurnal Serambi Ilmu Journal to continue to improve the quality of its manuscripts since the volume 23 number 2 has been published full in English.

We are also be proud that the number of submitted manuscripts is quite large, but only a few are acceptable and worthy of publication. This means that Jurnal Serambi Ilmu has become one of the scientific publications that are considered by experts and education enthusiasts.

For this reason, Jurnal Serambi Ilmu is committed to continuing to maintain the quality, service and discipline that applies in scientific publications.

September 30, 2022
Editor in chief,

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GARUDA
GARBA RUJUKAN DIGITAL



Andragogy Approach in the Utilization of Liquid Smoke Coconut Waste as a Vegetable Insecticide for Coconut Farming Community

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Abstract

Appropriate technology learning must be able to touch all levels of society. In this research, we combine formal education with informal education in the form of participatory education for adults. Participatory education is intended to involve the community directly participating in the implementation of this research by seeing, doing, and observing the process. The aim is how to utilize liquid smoke from coconut frond waste as a vegetable insecticide as well as a repellent or insect repellent because it contains phenol or phenolic, antioxidant, antimicrobial in coconut plants in the people of Aceh Besar. Based on the results of chemical analysis in liquid smoke found elements or chemical substances, such as acetic acid, carboxyl and phenol. This study aims to determine how the effect of temperature and duration of combustion on the yield (final product), such as the degree of acidity, acetic acid content, and phenol content. This research was carried out using a factorial Completely Randomized Design (CRD) with two main factors, namely: Factor-1 burning for 2-3 hours and Factor-2 with variations in temperature 200oC, 250oC, 300oC, 350oC, 400oC. The best result for liquid smoke is 25% (w/w) of 20 kg of dry matter from coconut fronds. The average content of acetic acid (CH₃COOH) is 6.45 mg/ml. And the content of phenol (C₆H₆O) is 3.76 ppm.

Keywords: *andragogy education, liquid smoke, vegetable insecticides.*

INTRODUCTION

Coconut plants including to the monocot class of the palmae family as oil-producing food crops. Morphologically the coconut tree consists of roots, stems, leaves, midribs, flowers, fruit, fruit skin, shell, fruit flesh and water. Coconut plant as a community economic producer. So far, people have used coconuts only for the use of fruit, water, coconut milk, and oil.

With current technological advances, the part of biomass in the form of organic matter can be used as other more useful materials. In addition, the midrib can be used as an alternative energy such as making environmentally friendly and sustainable vegetable pesticide products with a participatory education approach for adults.

Andragogy education is intended to involve coconut farmers in managing coconut yields and waste that have not been utilized optimally (Emilda, E., Mahsa, M., & Khairani, S. H: 2022). Materials from coconut plants can be used as various products, such as organic fertilizer or liquid smoke that has economic value (Sari, S. M: 2020).

Several previous studies on the use of liquid smoke as a vegetable pesticide such as that conducted by (Samharinto et al., 2021) on the use of liquid smoke from waste in oil palm as a natural and effective insecticide for controlling insect pests on cabbage plants. In another study (Wiyantono and Endang, 2019) the potential for liquid smoke to effectively control caterpillars on vegetable crops.

Pesticides can be defined as natural or artificial chemicals used to control plant pests in the form of living organisms, such as organisms or microorganisms. For farmers, types of pests or other nuisance bodies are considered detrimental (Ishak et al., 2019).

Synthetic pesticides can leave residues on plants after spraying. Pesticide residues in the form of certain materials or substances that are not decomposed by natural decomposition cycles are stored in plant tissues. Vegetable pesticides with balanced doses do not leave residues on plant parts, because it consists of organic elements that are easily decomposed in the decomposition cycle of plant physiology. The results of research conducted (Trenggono et al., 2017) in the process of liquid smoke using the pyrolysis method found a number of toxic compounds from liquid smoke, such as phenol 4.14%, carbonyl 1.30%, acid compounds 10.2%. Chemical compounds contained in liquid smoke tend to kill the bodies of plant pests.

To increase community participation in liquid smoke management, adult education or participatory education is needed (Hakim, L., Irhamni, I., Zainuddin, Z., & Burhanuddin, AG. 2018). Adult education (Andragogy) is an informal or non-formal education. (Coombs, 1973) in (Agus Winarti, 2018) that: non-formal education is any organized and structured activity that is outside the school system carried out independently to serve the community in achieving learning goals. Furthermore (Supriyanto, 2009) explains: adult education is a systematic and continuous learning process for adults that aims to update their knowledge, attitudes, values, and skills. The habits of adults or parents often appear statements like this: I hear and I forget, I see and I remember, I do and I understand (Kong Fu Cu in Sudijanto, 2016).

Adult learning (andragogi) needs can be interpreted as the integrity of an organized educational mechanism, such as job training that makes adults have the potential to develop economic, socio-cultural, and new technologies in a balanced and sustainable

manner. The realization goals that will be developed in the activities are, first to realize the development of each individual. Second, realize their participation in activities related to new innovations.

According to (Agus Winarti, 2018) there are several factors that affect adult learning psychologically as follows: first, future expectations so that they can motivate learning. The second is social background, the third is family support, and the fourth is with skills that can stimulate memory. Because psychologically, the older the age will decrease the memory, and vice versa the logic of thinking increases. Basically, the principle of adult learning has several stages: first, the desire to learn will appear along with interests and fulfillment of needs. Both learning orientations are closely related to life and needs, if the needs are met, the learning conditions will be better. All three people can combine theory with knowledge or experience. The four adults have the ability to control themselves where experience is the best teacher. The five individual differences will become more real with increasing age, meaning that individual traits will disappear with age.

This research was conducted by involving coconut farming communities in utilizing coconut waste to be used as an effective and efficient product by inviting them to see and carry out the process of how liquid smoke is made. The intended coconut waste is fruit skin, shell, leaves, and bees. This research was conducted by involving coconut farming communities in utilizing coconut waste to be used as an effective and efficient product by inviting them to see and carry out the process of how liquid smoke is made. The intended coconut waste is fruit skin, shell, leaves, and bees. The ingredients found in coconut trees are organic materials that are easily decomposed and decomposed with the environment, so they do not have a residual effect. The product produced from coconut waste raw material is old fronds that have fallen to the ground to be processed into liquid smoke as a vegetable insecticide.

Liquid smoke raw materials can be used from all plant materials that contain a lot of carbon elements. Coconut frond is a plant material that can be used as a basic material for the process of making liquid smoke which in foreign terms is called wood vinegas, liquid smoke (Basri, 2010). Coconut midrib, which is an organic material, contains nutrients that are very potential and can be used sustainably, such as 27.9% cellulose, 21.1% hemicellulose, 16.9% lignin, and 31.9% crude fiber (Imsya, 2007). community custom, coconut fronds are only used as firewood, raw material for organic fertilizers and other handicraft needs. However, when viewed from the chemical content, coconut fronds can be processed into liquid smoke for further use as an alternative insecticide in controlling pests on plants.

Thermochemical decomposition at a temperature of 400-600oC under vacuum without oxygen is called pyrolysis. In this decomposition process, volatile substances are released, while non-volatile solids will collect as biochar (Kasim et al., 2020). Part of the volatile gas phase is black condensation called Bio Oil, such as tar in the smoking event, wood oil, wood distillation or liquid smoke. Biochar is a material that is rich in

carbon as a result of the conversion of organic waste (plant biomass) through incomplete combustion or lack of oxygen supply (pyrolysis). Plant biomass can be in the form of roots, stems, bark, midrib leaves, and others from plant organs. This biomass will easily decompose in the open environment.

Variations in temperature, heating time and heating time are characteristics of the pyrolysis method. According to (Dickerson, 2013) the pyrolysis method can be grouped into two, namely slow pyrolysis and fast pyrolysis. Slow pyrolysis at a heating rate of 0.1-10°C per second with a half-life of 5-7 minutes at a heating temperature of 400-600°C. This method has been used for a long time with yields similar to those of charcoal, liquids and gases. While fast pyrolysis gets high yields because it is carried out by fast heating at a temperature of 100-1000°C per second, but the heating time is very short, which is less than 2 seconds. The fast method is very expensive when compared to the slow method, because the fast method is very wasteful of energy use.

The production of liquid smoke is obtained from the combustion of active biomass consisting of cellulose, hemicellulose, lignin, lipids, proteins, simple sugars, starch, water, hydrocarbons, and ash content. Cellulose (C₆H₁₀O₅)_n and Hemicellulose (C₅H₁₀O₅)_n are organic compounds which are the main structure of green plant cell walls. Lignin is a wood substance that is the main component of plants. Lipids (fats) are important organic compounds for plants that function as a source of metabolic energy and essential fatty acids that play a role in cellular structure for the maintenance and integrity of biomembranes. Protein functions to produce enzymes and hormones, repair damaged cells, and carry hereditary traits. All of these ingredients are found in liquid smoke.

Liquid smoke can be obtained through distillation or condensation from combustion products. The content of liquid smoke is largely determined by the raw materials used. Based on the results of the GCMS (Gas Chromatography Mass Spectrometry) test, 61 potential chemical compounds were found, consisting of 17 ketone compounds, 14 phenolic compounds, 8 carboxylic compounds, 7 alcohol compounds, 4 ester compounds, 3 aldehyde compounds (Budiyanto, et.al., 2008)).

According to (Tranggono, et.al., 1997) more specific liquid acid also contains 5.13% phenol, 13.28% carboxyl, 11.39% organic acid. This study aims to utilize organic matter from coconut fronds as raw material for liquid smoke and can be applied as an alternative insecticide.

METHOD

Research Participants

The research participants were coconut farmers around Aceh Besar District who were randomly selected to represent 10 people in each village. They became participants who also witnessed and monitored the process of making the insecticide. With such a role, Maraka can ask questions and submit various opinions to strengthen the results of this study.

Materials and Tools

This research was conducted in a laboratory by involving coconut farming communities to see, conduct, and observe every step of the research. This research is also guided by one tutor who is assisted by students and the community as non-formal

students. The raw material for coconut fronds is obtained from the Samahani village community, Aceh Besar District. Coconut fronds that have been collected and dried for 10 days, so that they reach an average moisture content of 15%, then reduce the size and weigh as much as 30 kg. The chemicals needed for this research consist of NaOH (sodium hydroxide), H_3PO_4 (phosphoric acid), NH_4CL (ammonium chloride), NH_4CL (ammonium hydroxide), 4-aminoantipyrine 99%, $K_3[Fe(CN)_6]$ is Potassium ferrocyanide, $CHCl_3$ (Chloroform), Na_2SO_4 (Sodium sulfate), $CUSO_4$ (copper sulfate). These chemicals are obtained from chemical stores.

The equipment used in this study consisted of a reactor unit for pyrolysis, a condenser unit as a coolant, a measuring cup, an elenmeyer, a spectrophotometer, and a digital thermocouple. These tools were obtained from the Chemical Engineering Laboratory, Syiah Kuala University, Darussalam, Banda Aceh.

Time and place

This research was conducted experimentally using a Factorial Completely Randomized Design (CRD) which was divided into 2 (two) factors, namely factor-1 with respect to the length of combustion with an interval of 2-3 hours. and factor-2 is the temperature variation from 200oC, 250oC, 300oC, 350oC, 400oC. Each treatment was repeated 1 time, for a total of 10 experimental units.

The research site is the Chemical Engineering Laboratory, Faculty of Engineering, Syiah Kuala University (USK) in 2020. The variables observed were: yield, acidity (pH), acetic acid content, and phenol content.

Research procedure

The procedure for making liquid smoke using a modified model (Prasetyowati, et.al., 2014), is as follows: 1) prepare a condenser unit that functions as a condenser to lower the temperature in the refrigerator when condensation occurs, which flows through the receiver dryer and continues to expand. values. 2) pieces of coconut fronds that have been reduced in size are inserted into the combustion reactor, each 2 kg. 3) the smoke funnel is connected by using a hose attached to a thermocouple leading to the reactor and the pyrolysis device which is the place for burning raw materials. 4) start burning until it reaches a temperature of 200, 250, 300, and 400oC for 2 to 3 hours. 5) During combustion keep the temperature always stable. 6) the condensation results are put into an erlenmeyer for the separation process. 7) After the separation process is carried out, the liquid smoke yield is packed into bottles and stored at room temperature of 28-32oC. 8) then the final product of liquid smoke (rendemen) to be analyzed for pH content, phenol content, acetic acid content.

Prosedur analisis

Data analysis was carried out using the following formula:
$$\text{Kadar asam (mg/mL)} = \frac{\text{mL titran} \times N \text{ NaOH} \times \text{BM asam asetat}}{\text{Volume asap cair (mL)}} \times 100\%$$

$$\text{Rendemen (\%)} = \frac{\text{Volume (mL)}}{\text{Berat bahan (g)}} \times 100\%$$

Variables observed for liquid smoke were yield using the formula for calculating percentage yield, degree of acidity (pH), acetic acid content, and phenol content. The pH measurement was carried out using a pH meter previously calibrated with a buffer solution. The measurement of phenol content was carried out in the following steps: 5 ml of liquid smoke and then added water until it reached a volume of 100 ml, added H_3PO_4 with a volume of 1 ml and added CuSO_4 with a volume of 1 ml, then the first distillation was carried out until it reached a volume of 80 ml. volume of 100 ml.

The next step is the distillate added 2 ml of NH_4Cl and 1 ml of NH_4OH . Then 0.5 ml of aminoantipyrine solution was added and shaken. Next, add 0.5 ml of potassium ferricyanide solution and shake and allow to stand, then extract with 5 ml of chloroform. The extract that has been obtained is filtered using filter paper, then the results are immediately measured by a spectrophotometer with a wavelength of 480 nm.

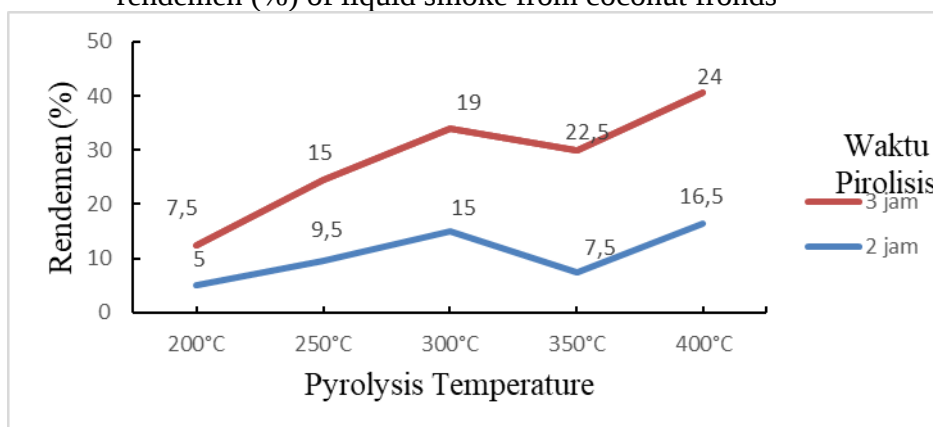
RESULTS AND DISCUSSION

1. Rendemen

The net yield (rendemen) of liquid smoke is calculated by comparing the weight of liquid smoke obtained with the amount of raw materials used. The yield will increase with the increase in the pyrolysis temperature, and vice versa, the decrease in yield occurs due to the low pyrolysis temperature. Based on the results of the study presented in graph 1 below, the highest liquid smoke yield was obtained at 3 hours heating with a temperature variation of 400°C, namely 24 (% w/w) was the concentration in percent by weight, then decreased followed by a heating time of 2 hours and a temperature variation of 200°C. by 5 (% w/w).

Grafik 1

Effect of pyrolysis time and temperature variation on the rendemen (%) of liquid smoke from coconut fronds



Source: Research Results in 2021

Randemen ratio of liquid smoke produced which is directly proportional to the total weight of the raw materials used before combustion. The rendemen calculation

technique is to calculate the weight of the material used for the liquid smoke produced in each treatment by taking the average value (Riska et al., 2021). The yield of liquid smoke based on the length of combustion time and temperature variations increased with increasing pyrolysis time and temperature.

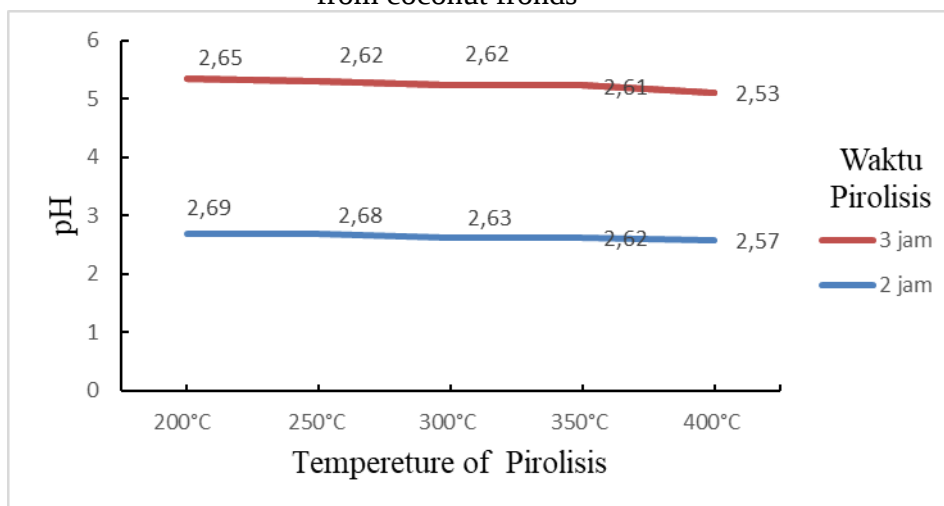
This is because the speed of heating time and the amount of heat used can affect the yield. The duration of heating and heating temperature can increase in yield, and vice versa, short heating time and low temperature will decrease rendement (Girard, 1992) and (Maulina and Putri, 2017).

There was an increase in the rendement of liquid smoke with increasing time and pyrolysis. This can occur because the combustion of organic materials such as hemicellulose and lignin will undergo pyrolysis to produce three groups of condensable folate compounds (Sari, 2006). During the pyrolysis process with a time span of 1-3, there is a release of water accompanied by CO and CO₂ gases and evaporation occurs. Other materials such as cellulose, hemicellulose and lignin undergo decomposition (Siskos et al., 2006).

2. Degree of Acidity (pH)

The level of acidity is a benchmark for setting the level of acidity or base possessed by a substance, solution or liquid or solid. Based on the results of the research, the pH degree of liquid smoke from 2.53 to 2.69 varied based on the heating time and temperature variations in each treatment.

Grafic 2.
 Effect of pyrolysis time and pyrolysis temperature on the pH of liquid smoke from coconut fronds



Source: Research Results in 2021

The pH value is an important parameter to the final result of liquid smoke. pH measurement aims to determine the level of acidity of a material with a pH range of < 6 indicates acid and > 6 is called alkaline.

Based on the results of research conducted by Diatmika et al., (2019) that the lower the pH value, the better the quality of liquid smoke. Based on the research results, the highest pH of liquid smoke (2.69) was obtained at a pyrolysis temperature of 200oC and with a time of 2 hours, while the lowest (2.53) was at a temperature of 400oC with a pyrolysis time of 3 hours. The results of this study indicate that the liquid smoke produced is acidic. This acidic nature can come from the compounds contained in the raw material of coconut fronds. The pH value decreases with increasing temperature up to 400oC.

This can be caused by the high temperature, the more elements in the coconut midrib break down to form acidic compounds (Kasim et al., 2015). Liquid smoke with high acidity can be used as a natural food preservative (Basri, 2010). The administration of liquid smoke in the bacterial test resulted in an increase in bacterial mortality in the administration of 15% liquid smoke (Alamsyah et al., 2020).

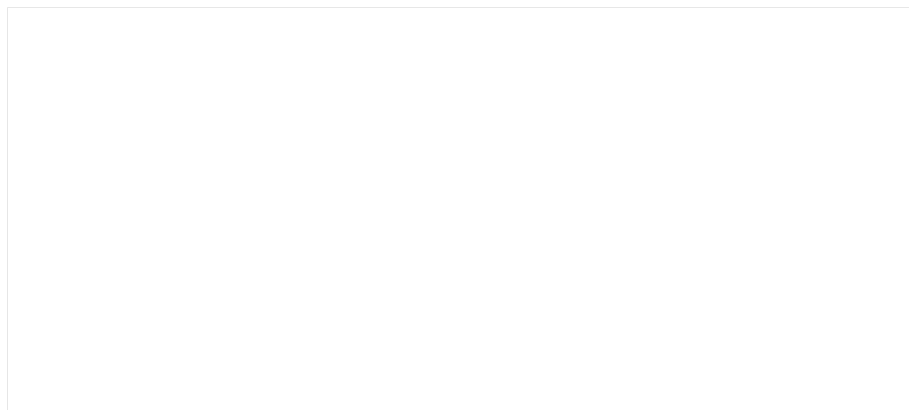
3. Acetic Acid Level

Based on the results of research on acid levels, acid content is an important content of liquid smoke. The difference in the amount of acid content is due to the organic acids produced from the decomposition of cellulose components, Hemicellulose and lignin have undergone a more complete pyrolysis process at higher combustion temperatures. The highest acetic acid level of 6.45 mg/ml was found at 400oC pyrolysis temperature treatment for 3 hours, the lowest was 3.90 mg/ml at 200oC pyrolysis temperature treatment in the same 3 hours. The acid level in liquid smoke is seen as a whole content of acid compounds contained in the liquid smoke.

Acid compounds in an organic material or plant material as antibacterial. On the other hand, the acid content in a fishery product, such as smoked fish, will give it a distinctive taste. According to (Diatmika et al., 2019) the acid content in liquid smoke consists of acetic acid, propionic acid, butyric acid, and valeric acid. The more acid content in the liquid smoke, the better the quality.

Grafik 3.

Pengaruh waktu pirolisis dan suhu pirolisis terhadap kandungan asam asetat.



Source: Research Results in 2021

The longer the pyrolysis time, the higher the acetic acid content, this can be due to the main content of coconut midrib as organic matter having decomposed into organic acid components, such as carboxylic acid and acetic acid (Zuraida et al., 2011). Acetic

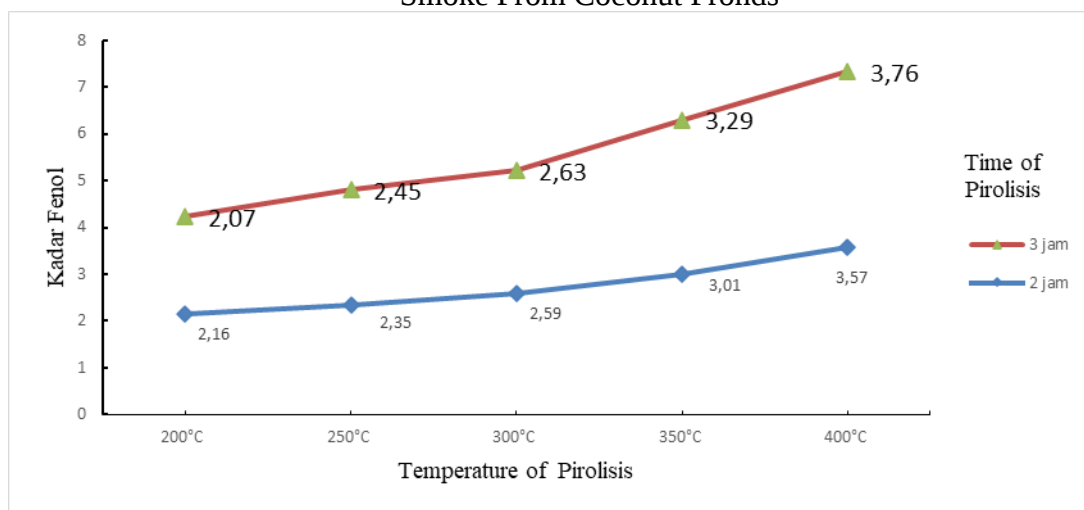
acid in liquid smoke is the second stage of hemicellulose pyrolysis which is a polymer such as pentosan and hexosan (Kasim et al., 2015). The pyrolysis time of 3 and a temperature of 400oC resulted in the pyrolysis process of hexosan producing more acetic acid, while at a temperature of 200oC there was still a small amount of hexosan decomposed into acetic acid.

4. Phenol levels

Based on the results of testing the phenol content of each treatment, the highest phenol value was obtained at 400oC temperature treatment and 3 hours of pyrolysis time of 3.76 ppm. The lowest was at 200oC with the same pyrolysis time of 3 hours at 2.07 ppm.

Grafic 4.

Effect Of Pyrolysis Time And Pyrolysis Temperature On Phenol Content Of Liquid Smoke From Coconut Fronds



Source: Research Results in 2021

Phenol is a compound that functions as an antioxidant and gives flavor to food products and can extend shelf life. Phenol compounds are also potential compounds in providing flavor to food by using smoking. The phenol content in liquid smoke is influenced by the lignin content of the base material and the pyrolysis temperature. Lignin is basically a phenol produced from the breakdown of lignin at high pyrolysis temperatures (Heygree and Bowyer, 2008). when the temperature is still 200oC the lignin has not decomposed so that it affects the phenol content produced. The phenol content in liquid smoke is also an insecticide from natural ingredients (Basri, 2010).

CONCLUSION

Based on the results of the study discussing liquid smoke from the midrib with variations in temperature and burning time to be used as a vegetable insecticide, it can be concluded as follows:

1. Coconut fronds or other parts of coconut are very suitable to be used as liquid smoke. because liquid smoke can benefit the community to be used as vegetable pesticides, preservatives for fishery products. Because liquid smoke contains antibacterial elements, as a flavor in food or fish sale.
2. The process of making liquid smoke by involving coconut farmers as a participatory educational approach for adults is intended to increase the repertoire of knowledge and skills in handling coconut waste and to be continued in a sustainable and sustainable manner.
3. The yield (final yield) of liquid smoke obtained is 24 (% w/w) which is the percent by weight of solute from 20 kg of coconut frond raw material. The best treatment for yield is at a combustion temperature of 400oC with a burning time of 3 hours.
4. Pyrolysis process is an activity of thermochemical decomposition of biomass material through a heating process with a little oxygen with the final product in the form of gas. The best pyrolysis treatment with a heating temperature of 400oC for 3 hours.
5. The pH value or acidity level of liquid smoke reaches 2.65 in the acid category. This treatment was found on heating at 400oC for 3 hours.
6. The acid content of liquid smoke from coconut fronds is 6.45 mg/ml at a heating temperature of 400oC for 3 hours.
7. The content of phenol or carbolic acid in the form of colorless crystals with the chemical formula C₆H₅OH. The best treatment is burning at a temperature of 400oC with a burning time of 3 hours with a volume (3.76 ppm).

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